

CLIMATOTHERAPY AND BALNEOTHERAPY

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THE CLIMATES AND MINERAL WATER HEALTH RESORTS (SPAS) OF EUROPE AND NORTH AFRICA

INCLUDING THE GENERAL PRINCIPLES OF
CLIMATOTHERAPY AND BALNEOTHERAPY, AND HINTS AS TO THE
EMPLOYMENT OF VARIOUS PHYSICAL AND DIETETIC METHODS

BEING A THIRD EDITION OF
'THE MINERAL WATERS AND HEALTH RESORTS OF EUROPE'
MUCH ENLARGED IN RESPECT TO
MEDICAL CLIMATOLOGY

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CONTENTS

	PAGE
PREFACE	9

PART I

CLIMATOTHERAPY AND CLIMATIC HEALTH RESORTS

INCLUDING A CHAPTER ON OCEAN CLIMATES AND SEA VOYAGES

CHAP.		
I.	GENERAL CLIMATOLOGY	15
II.	CLASSIFICATION OF CLIMATES AND CHARACTERISTICS OF THE DIFFERENT CLASSES	52
III.	DESCRIPTION OF HEALTH RESORTS	69
IV.	THE MEDITERRANEAN COAST AND NORTH AFRICA	78
V.	MADEIRA, THE CANARY ISLANDS, AND THE AZORES	112
VI.	THE COAST RESORTS OF THE WESTERN PART OF THE EUROPEAN CONTINENT	117
VII.	INLAND EUROPEAN RESORTS—SWITZERLAND	134
VIII.	INLAND EUROPEAN RESORTS—NORTH ITALIAN LAKES, ITALY, SPAIN AND PORTUGAL, FRANCE, BELGIUM, NORWAY AND SWEDEN	161
IX.	INLAND EUROPEAN RESORTS—GERMANY, AUSTRIA-HUNGARY, ROU- MANIA AND BULGARIA, RUSSIA	186
X.	THE BRITISH ISLANDS	233
	APPENDIX TO CHAPTER X. WITH TABLE OF METEOROLOGICAL MEANS	280
XI.	THE CAPITALS AND GREAT TOWNS OF EUROPE. VISITS TO INTER- ESTING SMALLER TOWNS	281

PART II

BALNEOTHERAPY AND MINERAL WATER HEALTH RESORTS (SPAS)

INCLUDING CHAPTERS ON HYDROTHERAPY IN CHRONIC DISEASES, AND ON LOCALITIES
FOR AN AFTER-CURE TO SPA-TREATMENT

XII.	HYDROTHERAPY, OR THE THERAPEUTIC USE OF PLAIN WATER IN CHRONIC DISEASES	299
XIII.	CONSTITUENTS AND CLASSIFICATION OF MINERAL WATERS	316

CHAP.	PAGE
XIV. ACTION OF MINERAL WATERS ON THE ORGANISM IN THEIR EXTERNAL AND THEIR INTERNAL EMPLOYMENT	331
XV. THE INFLUENCE OF CHANGE OF AIR AND DIET AND HABITS IN THEIR CONNECTION WITH SPA-TREATMENT—ORDINARY MEDICAL AND SURGICAL TREATMENT AT SPAS—ACCESSORY SPA-TREATMENT—MUSCULAR EXERCISES AND MASSAGE IN CONNECTION WITH SPA-TREATMENT	352
XVI. DAILY LIFE AT SPAS—DURATION OF THE CURE—NECESSITY FOR MEDICAL SUPERVISION—DIET AT SPAS—SEASONS FOR THE CURE—IMPORTANCE OF AN 'AFTER-CURE'	364
XVII. SIMPLE THERMAL WATERS	370
XXVIII. MURIATED, CHLORIDE OR COMMON SALT WATERS WITH A NOTE ON SEA WATER AND SEA WATER BATHS	399
XIX. SIMPLE ALKALINE WATERS	452
XX. MURIATED (CHLORIDE-CONTAINING) ALKALINE WATERS	463
XXI. SULPHATED ALKALINE WATERS	474
XXII. SULPHATED AND MURIATED SULPHATED WATERS	488
XXIII. IRON OR CHALYBEATE WATERS	496
XXIV. ARSENICAL WATERS	525
XXV. SULPHUR WATERS	532
XXVI. EARTHY OR CALCAREOUS WATERS	582
XXVII. SIMPLE GASEOUS WATERS, TABLE WATERS, AND VERY WEAKLY MINERALISED COLD WATERS	596
XXVIII. LOCALITIES FOR AN AFTER-CURE TO SPA-TREATMENT	605

PART III

INDICATIONS FOR TREATMENT—THE USE AND SELECTION OF CLIMATES, MINERAL WATERS, AND HEALTH RESORTS IN CHRONIC DISEASES AND MORBID CONDITIONS

WITH HINTS AS TO THE EMPLOYMENT OF VARIOUS PHYSICAL AND DIETETIC METHODS

XXIX. INTRODUCTORY—ON ASSOCIATED THERAPEUTIC FACTORS IN THE EMPLOYMENT OF CLIMATES, HEALTH RESORTS, AND SANATORIA—GRAPE CURES, MILK CURES, ETC.	613
XXX. SANATORIUM TREATMENT	625
XXXI. GENERAL CONSIDERATIONS IN REGARD TO THE SELECTION OF HEALTH RESORTS	631
XXXII. CONSTITUTIONAL DISORDERS AND DISEASES OF METABOLISM	638

CONTENTS

7

CHAP.	PAGE
• XXXIII. TUBERCULOSIS	668
XXXIV. DISEASES OF THE RESPIRATORY ORGANS OTHER THAN CONSUMPTION	687
XXXV. DISEASES OF THE CIRCULATORY SYSTEM	693
XXXVI. DISEASES AND DISORDERS OF THE DIGESTIVE APPARATUS . . .	699
XXXVII. DISEASES OF THE URINARY ORGANS	712
XXXVIII. DISORDERS OF THE SEXUAL SYSTEM	718
XXXIX. DISEASES OF THE NERVOUS SYSTEM AND OF THE EYES AND EARS	724
XL. AFFECTIONS OF THE SKIN	741
BIBLIOGRAPHY	745
INDEX	775

PREFACE

THE present edition is divided into three parts, dealing respectively with Climatotherapy, Balneotherapy, and the Methodical Selection of Health Resorts (including Mineral Waters, &c.).

In Part I the first two chapters are concerned with the general matter of Medical Climatology, whilst the remaining portion contains a description of the Climatic Health Resorts of Europe and North Africa, together with a chapter on Ocean Climates and Sea Voyages.

In Part II the general subjects of Hydrotherapy and Balneotherapy are followed by a description of the Mineral Water Health Resorts (Spas). As many of the Spas described in Part II have likewise had to be mentioned amongst Climatic Health Resorts in Part I a certain amount of repetition¹ has been unavoidable. Since the publication of the first edition of this book (ten years ago) numerous experimental investigations have been conducted by various observers, chiefly on the Continent, into the action of mineral waters upon the organism, particularly in regard to their effects on the digestive organs and metabolism, both in animals and man, in health and disease. To several of these investigations we have referred in Part II, as also to the ion theory and to considerations concerning the osmotic and other 'chemical-physical' properties of mineral waters.

Part III is devoted to the selection of Health Resorts and Therapeutic Methods and their various uses in the different chronic diseases and morbid conditions.

¹ Part I is intended to give an account of all health resorts, including a short notice of every well-known spa and its waters, the more detailed account of the waters being reserved for the notice of the spa in Part II.

We have specially to thank Messrs. P. Blakiston's Son & Co., of Philadelphia, for their kindness in allowing Dr. Parkes Weber to incorporate material which he contributed to their 'System of Physiologic Therapeutics,' and we have equally to thank Professor S. Solis Cohen, of Philadelphia, the editor of that 'System,' for his great courteousness in the same respect. Our acknowledgment and thanks are due to Mr. W. Marriott, of the Royal Meteorological Society, for valuable assistance in certain sections of Part I; and likewise to the officials of the London Meteorological Office for their civility and readiness in supplying information.

The present volume is not only a third edition of the 'Spas and Mineral Waters of Europe,' first published in 1896, but is also a modern edition of Hermann Weber's 'Climatotherapy' (published in Germany in 1880 and in England in 1885), and likewise (owing to the kindness of Messrs. Blakiston's Son & Co.) is practically a new edition of the greater portion of Parkes Weber's contributions to the volumes on Climatology mentioned above.

The list of writings on the subject given in the Bibliography at the end of the book, though certainly a large one, has still no pretensions to be a complete one. It includes, however, besides many articles and monographs on special localities and therapeutic methods, most of the more general English, German, and French works, many of which the authors have largely made use of.¹ It must be remembered that a treatise like the present one is necessarily, to a great extent, a compilation; but since the edition of 1898 very many of the localities described, both in the British Islands and on the Continent, have been visited by one or other of the authors. To facilitate reference great care has been taken to make the index as complete as possible; it is a general index to the whole book, and specially thick (black) figures have been used to distinguish the main references when several different pages are referred to.

¹ Of more or less general works on the subjects under consideration we must specially mention the writings of the following authors: W. Bain, F. C. Bayard, Braun, A. Buchan, K. Chyzer, Durand-Fardel, R. Flechsig, M. G. Foster, J. Glax, K. Grube, Gsell-Fels, J. Hann, E. de la Harpe, W. R. Huggard, E. H. Kisch, A. Labat, J. Macpherson, C. von Noorden, H. Reimer, P. Schivardi, Seegen, Senator, S. E. Solly, Valentiner, Vintras, F. R. Walters, C. T. Williams, Burney Yeo, and the various contributors to *The Climates and Baths of Great Britain*, 1895-1902.

Throughout the book distances have been expressed in English miles, altitudes in feet, and temperatures (except in regard to the freezing points of mineral waters) in degrees of the Fahrenheit scale, but for the convenience of readers accustomed to the metric system we also include conversion tables. In regard to analyses of mineral waters the amounts of the principal solid constituents have been expressed as grammes per litre, that is, per 1,000 cubic centimetres of the water, but the number of grammes need only be multiplied by seventy to transform it into the number of grains per imperial gallon.

Though much experimental work has already been carried out by various investigators regarding the action of climates and spa-treatment, much obviously remains to be done, particularly in regard to the effects of the various separate factors in climato-therapy and balneotherapy. Thus, besides the necessary increase in heat production and carbohydrate catabolism due to moderate cold, we know (see Chapter II) that at moderately high altitudes, when a suitable amount of muscular exercise is taken, the nitrogenous metabolism is influenced so that the proteid assimilation (by anabolism) becomes greater than the proteid loss (by catabolism). But how long does this process of proteid gain in the body continue before the stage of equilibrium is reached? How does it compare with the effects in this respect of an ordinary holiday (with open-air life) or of residence in a sanatorium at the seaside or at inland localities of low elevation?

Many points in regard to the effects of high altitudes on the blood remain to be settled (see Chapter II), and it must not be forgotten that contradictory findings in this department of investigation, as in others, may sometimes be explained by individual peculiarities in physiological reaction. Numberless questions similar to the preceding ones may occur to readers—questions generally easier to ask than to answer, many of which, however, will probably be answered at no very distant date by enthusiastic investigators on the subject.

HERMANN WEBER.

F. PARKES WEBER.

December 1906.

CONVERSION TABLES

In the text of this volume temperatures are expressed in degrees Fahrenheit, altitudes in English feet, and distances in English miles, but the following conversion tables may be found useful :

Temperatures : CENTIGRADE AND FAHRENHEIT DEGREES.

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
00	32	70	158	40	104	10	50	-20	-4
99	210.2	69	156.2	39	102.2	9	48.2	-21	-5.8
98	208.4	68	154.4	38	100.4	8	46.4	-22	-7.6
97	206.6	67	152.6	37	98.6	7	44.6	-23	-9.4
96	204.8	66	150.8	36	96.8	6	42.8	-24	-11.2
95	203	65	149	35	95	5	41	-25	-13
94	201.2	64	147.2	34	93.2	4	39.2	-26	-14.8
93	199.4	63	145.4	33	91.4	3	37.4	-27	-16.6
92	197.6	62	143.6	32	89.6	2	35.6	-28	-18.4
91	195.8	61	141.8	31	87.8	1	33.8	-29	-20.2
90	194	60	140	30	86	Zero	32	-30	-22
89	192.2	59	138.2	29	84.2	-1	30.2	-31	-23.8
88	190.4	58	136.4	28	82.4	-2	28.4	-32	-25.6
87	188.6	57	134.6	27	80.6	-3	26.6	-33	-27.4
86	186.8	56	132.8	26	78.8	-4	24.8	-34	-29.2
85	185	55	131	25	77	-5	23	-35	-31
84	183.2	54	129.2	24	75.2	-6	21.2	-36	-32.8
83	181.4	53	127.4	23	73.4	-7	19.4	-37	-34.6
82	179.6	52	125.6	22	71.6	-8	17.6	-38	-36.4
81	177.8	51	123.8	21	69.8	-9	15.8	-39	-38.2
80	176	50	122	20	68	-10	14	-40	-40
79	174.2	49	120.2	19	66.2	-11	12.2	-41	-41.8
78	172.4	48	118.4	18	64.4	-12	10.4	-42	-43.6
77	170.6	47	116.6	17	62.6	-13	8.6	-43	-45.4
76	168.8	46	114.8	16	60.8	-14	6.8	-44	-47.2
75	167	45	113	15	59	-15	5	-45	-49
74	165.2	44	111.2	14	57.2	-16	3.2	-46	-50.8
73	163.4	43	109.4	13	55.4	-17	1.4	-47	-52.6
72	161.6	42	107.6	12	53.6	-18	-0.4	-48	-54.4
71	159.8	41	105.8	11	51.8	-19	-2.2	-49	-56.2

Heights : METRES AND ENGLISH FEET.

Feet.	Metres.	Feet.	Metres.	Feet.	Metres.	Feet.	Metres.	Feet.	Metres.
1	3.2	8	26.2	60	196.8	400	1,312.3	1000	3,280.8
2	6.5	9	29.5	70	229.6	500	1,640.4	2000	6,561.7
3	9.8	10	32.8	80	262.4	600	1,968.5	3000	9,842.6
4	13.1	20	65.6	90	295.2	700	2,296.6	4000	13,123.5
5	16.4	30	98.4	100	328	800	2,624.7	5000	16,404.4
6	19.6	40	131.2	200	656.1	900	2,952.8		
7	22.9	50	164	300	984.2				

Distances : KILOMETRES AND ENGLISH MILES.

Kilo-metres.	Miles.	Kilo-metres.	Miles.	Kilo-metres.	Miles.	Kilo-metres.	Miles.	Kilo-metres.	Miles.
1	0.6	5	3.1	9	5.5	40	24.8		49.7
2	1.2	6	3.7	10	6.2	50	31		55.9
3	1.8	7	4.3	20	12.4	60	37.2	100	62.1
4	2.4	8	4.9	30	18.6	70	43.4	200	124.2

NOTE.—The higher temperatures are given because the temperatures of mineral waters as well as atmospheric temperatures are mentioned in the present volume. The temperature of some thermal springs is close to or actually that of boiling water.

In the analyses of mineral waters the amounts of the principal solid constituents are expressed as grammes per litre, that is to say, as grammes per 1,000 cubic centimetres of the water, but this quantity *per mille* need only be multiplied by 70 to transform it into the number of grains per imperial gallon.

PART I

**CLIMATOTHERAPY AND CLIMATIC
HEALTH RESORTS**

**INCLUDING A CHAPTER ON OCEAN CLIMATES
AND SEA VOYAGES**

CHAPTER I

GENERAL CLIMATOLOGY

DEFINITION OF CLIMATE

By the term 'climate' meteorologists mean the average condition of meteorological phenomena at a given place ; while by 'weather' they mean the condition of the atmosphere at any moment with regard to wind, temperature, cloud, and precipitation. From the point of view of the physician and the biologist, climate is the combination of the various conditions of the atmosphere and the earth's surface which determines the suitability of a region or site for the life and health of animals and plants.¹ In the study of climato-therapeutics, which is intimately connected with those of general sanitation and public health, we are concerned only with the effects (direct or indirect) of climate on man, but observations on the flora and fauna can furnish us often with valuable information as to the temperature, humidity, equability, sunshine, winds, and nature of the earth's surface of a locality, all of which will have obvious bearings on the probable suitability of the place in question for man in general, and for persons of different constitutions. A climate which may be termed good, in the sense that it favours the development of races of men both vigorous in body and capable in mind, is a climate characterised by frequent moderate variations in the weather. Such a climate exercises the powers of adaptation and resistance of the different organs without subjecting them to excessive strain, and thus keeps the body in proper working condition. But the best climate for one race is not necessarily the best climate for another race, and the most suitable climate for any particular person depends on his individual constitution and state of health, or disease. In regard to treatment of disease, it is important to remember that no climate is perfect, that irregular variations may occur in all climates, and that at most health resorts the climate is not

¹ On the definition of 'climate' see also 'Ueber den Begriff, Klima,' by Dr. K. E. Ranke, in the *Münchener medicinische Wochenschrift*, 1901, No. 52, p. 2111.

equally suitable for particular diseases at all seasons of the year. For any given class of cases that climate is a good one, says Sir H. Weber, in which the qualities which would be disadvantageous are to a certain degree absent during the whole year, or at least part of the year, whilst other qualities are present by the proper use of which the bodily strength is raised and the restoration of the affected organs and functions is facilitated.

The climate of any particular region or site is determined by :

1. The distance from the equator (latitude).
2. The elevation above sea-level (altitude).
3. The distance from and relation of the position to seas, inland lakes, and marshes.
4. Other features of the surroundings and the aspect of the site towards them. Slopes, level plains or deserts. High mountains, hills or forests affording shelter from the wind. Cliffs and rocks reflecting sunlight on to the place or cutting it off during portions of the day.

5. The prevailing winds, local and general: these depend practically on the preceding factors.

6. The nature of the soil, and the natural or artificial conditions connected with the surface of the locality and its neighbourhood. The ground may be rocky, porous (as in sandy localities) or clayey; permeable or impermeable to moisture; and according to its permeability and configuration of surface, dry or moist and suitable or unsuitable to good drainage. The surface may be bare or covered with a greater or lesser amount of vegetation (naturally or owing to irrigation and cultivation), and such conditions may considerably influence the moisture and range of temperature of the local atmosphere. If bare of vegetation the surface may be dark (black igneous rocks &c.) or light (yellowish sand and white chalky cliffs) and may reflect the sunlight with a glare; it may be hard and rocky, or soft and sandy or dusty. Sometimes only small portions of the surface may be bare (roads &c.), but in dry climates such areas may with the slightest wind give rise to disagreeable clouds of dust. In large towns the pavements and artificial surface drainage diminish the amount of evaporation, and therefore tend to lower local atmospheric humidity. The density of the population and the artificial conditions introduced by man are most important elements in determining the healthiness or unhealthiness of a climate. In this respect the amount of space occupied by buildings and dusty roads, the nature and extent of the local industries, and the presence or absence of large factories connected with them, the sufficiency or otherwise of the drains and general

hygienic arrangements of the neighbourhood, have specially to be noted.¹

We will now separately consider some of the main elements on which the climate and healthiness of a locality depend. Though each element is discussed as shortly as possible, a certain amount of repetition has been found unavoidable.

THE COMPOSITION OF THE AIR

Pure atmospheric air contains 20·99 parts per cent. by volume of oxygen and very nearly 79 parts of nitrogen and argon. The percentage of oxygen is remarkably constant. Angus Smith, however, found as much as 20·99 per cent. on the west coast of Scotland, but in the narrow streets of large towns, such as Manchester and London, the air may contain only 20·8 parts per cent. or less of oxygen. Argon, which constitutes slightly less than one per cent. of the atmosphere, appears to be chemically inert, and nearly all that is taken into the body can be found again in the expired air. The effects of the watery vapour and relative humidity of the air in modifying climate will be considered later on. The proportion of carbonic acid gas in the atmosphere varies very much relatively to that of oxygen. The amount in pure open air is given as 0·03 to 0·04 per cent., but it may be as low as 0·02 per cent., and in forests when there is no wind the proportion may be slightly increased. In the confined air of theatres, schools, law courts, and closed rooms, it may reach as much as 0·2, 0·6, or even 1 per cent. Hydrogen² and methane (or marsh gas) are present in the atmosphere in much smaller quantities than carbonic acid. In 1898 minute quantities of new elements, namely, neon, krypton, and xenon, were discovered in the air; and helium, found by Sir W. Ramsay in 1895 in certain minerals and shortly afterwards extracted from the waters of various thermal springs (see Part II, Chapter XIII), may sometimes likewise be present in traces in the atmosphere, like radium emanation from which it has been experimentally produced (Ramsay and F. Soddy).

Ozone, an allotropic form of oxygen, has a disinfectant action when present in sufficient quantity, but in the minute proportions in which it exists in the atmosphere (always less, it is said, than 1 in 700,000 parts) its actual effects on micro-organisms and on the human body cannot easily be estimated. It is said to be most

¹ On the hygienic requirements of modern health resorts see Dr. Hans Ruge, 'Die gesundheitlichen Mindestforderungen an Badeorte,' *Berliner klin. Wochenschrift*, April 17, 1905, p. 466.

² See Armand Gautier, *Annales de Chimie*, Paris, January 1901. The presence of free hydrogen in the atmosphere has been confirmed by Liveing and Dewar at the Royal Institution, London.

abundant on the sea coast, on mountains, in woods, and on desert plains; it is likewise augmented by intense sunlight and during rainy weather, particularly during thunderstorms, and is said to be more abundant in spring than in autumn. There is less ozone in houses and towns than in the open country, and it is altogether absent near putrefying substances.

Probably the chief importance of ozone in the air depends on the fact that its presence indicates absence of the injurious organic substances that quickly decompose it. On the other hand, an excessive proportion of carbonic acid gas, though possibly not sufficient to be itself injurious, generally indicates that the air is tainted by excess of organic impurities. Such impurities are frequently revealed by a disagreeable odour which accompanies them, but it is probable that their poisonous qualities have been overestimated by Brown-Séquard and D'Arsonval in their well-known researches on expired air, the effects attributed to poisonous organic excretions from the lungs being, perhaps, partly due to excess of carbonic acid gas and partly to the psychical influence of nauseating odours.

The probable excess of microbes, some of them doubtless pathogenic, in air containing excess of carbonic acid is of greater importance. Dr. Henry MacCormac long ago attributed the origin of pulmonary tuberculosis in great part to the effects of 'breath rebreathed,' and recently A. Ransome and A. Hillier have suggested that the effete organic material given off in the expired air may act as a pabulum or, at least, by its presence in excess, favour the growth of the tubercle bacillus. Ransome (Royal Society, 1898) found that tubercle bacilli could be cultivated at ordinary room-temperatures on wall-paper or filter-paper impregnated with moisture condensed either from expired air or from humid air arising from the ground.

Amongst various other substances which we have not yet mentioned, but which are more or less frequently present in the air, common salt (chiefly at the seaside) must especially be mentioned. Owing to the spray thrown up on the sea coast, sea air becomes charged with particles of salt water in suspension. This quality of sea air is, of course, most noticeable in stormy weather and on rocky and steep shores. The iodine, which is found in traces in sea air, appears, according to the researches of Armand Gautier, to exist in organic combinations, and may form part of minute organisms or fragments of organisms held in suspension in the air. According to Henriot (Acad. des Sciences, Paris, May 1904) minute quantities of formaldehyde exist in ordinary atmospheric air. The odours in the atmosphere from flowers, plants and other things (to which certain persons are in various

ways peculiarly susceptible) are supposed to be due to the presence of substances in the gaseous state and not, as some might have thought, to the presence of very fine particles in suspension, that is to say, not to the presence of a suspended 'powder' of minute solid or liquid particles. In laboratory experiments on artificial cloud formation scents will not provide 'condensation-nuclei' like dust will.

Dust¹ and Micro-organisms in the Air.—It was J. Tyndall who, by his well-known experiments with powerful beams of light, clearly drew attention to the countless floating particles in the air, and by his ingenious writings² and demonstrations threw light on their possible significance from a hygienic point of view. These particles are some of them organic, some inorganic. The *inorganic material* blown up by the wind from sandy deserts and dusty roads may be very irritating to the eyes, respiratory passages, and skin of the face; it constitutes a great drawback of many dry and otherwise valuable climates. The satisfactory results of treating dusty roads by means of petroleum or tar has been demonstrated experimentally in France, but the question of the practicability of such methods is mainly one of expense. The smoke or soot from fires constitutes one of the disadvantages of the neighbourhood of factories, and is the cause of the blackness of the well-known 'black fogs' of London. In large cities, like London, Glasgow, and Hamburg, it leads to great loss of sunshine and sunlight (see later), especially during the winter months. Dust showers of non-terrestrial origin (cosmic or meteoric dust rich in nickel) have occasionally been recorded. Dust can be carried to enormous distances by aerial currents; volcanic dust from eruptions of volcanoes in Iceland has been transported by aerial currents to Norway and Scotland, and dust swept up by whirlwinds from the deserts of Africa may be carried far away out to sea.

Organic dust, set free during various industrial processes from plant fibre, animal skins, &c., may, like inorganic dust, cause great annoyance and do harm by mechanical irritation of the respiratory passages, &c., but some kinds of organic dust may be injurious owing to their chemical and, still more so, owing to their vital properties. Thus pollen of plants gives rise to 'hay-

¹ Dust, metallic fumes, and other impurities in the air are well-known causes of disease in certain trades. We need only mention the bronchial and pulmonary affections of metal-grinders, stone-grinders, workers in mother-of-pearl, &c. Happily these affections can be largely diminished in frequency by the exercise of proper precautions. The whole subject is dealt with in works on Public Health, Trade Diseases and their Preventive Treatment, &c.

² See 'Dust and Disease,' in his *Fragments of Science*, London, 1871; also his *Essays on the Floating Matter of the Air*, London, 1881.

fever' in susceptible individuals, and pathogenic microbes, if present in the dry dust or attached to particles of water floating in the air, may cause infectious diseases. The number of microbes in the air of the crowded portions of large towns appears enormous. In large windy towns during cold dry winters, when the ground remains frozen for long periods together, and cannot be cleaned with water in the usual way, the annoying dust swept up by the wind from the roads consists not only of particles of organic refuse and excreta, but doubtless partly of living micro-organisms, pathogenic as well as non-pathogenic, though, as a matter of fact, pathogenic microbes are rarely detected in open air. Moulds are much more numerous than bacteria; C. Flügge (1897) gives 500 to 1,000 as the average of spores and microbes present in a cubic metre of open air, only 100 to 200 of them being bacteria. Where the general hygienic arrangements are good and accumulations of filth are not permitted, the quantity of bacteria in the air will naturally be less. Winds, showers of rain, and, above all, sunlight, are the natural purifiers of the air. The influence of sparsity of the population in regard to the number of microbes in the air of a district is obvious. Thus P. Miquel at Paris, from six years' observations, found the average number of microbes in a cubic metre of air taken from the crowded Rue de Rivoli to be 3,910, more than eight times the number (455) in the same quantity of air from the park of Montsouris. In the air of the Hôtel Dieu hospital he estimated the number of microbes as 79,000 per cubic metre.

From these considerations it seems natural that in the open spaces and parks of large towns the number of germs in the air is less than in the more crowded parts, that the air of the open country, especially that on the top of hills, compared with that of towns, is relatively free from microbes, and that these latter are practically altogether absent from the air of very high altitudes (away from towns) and from the air of the open ocean and of the Arctic regions.

TEMPERATURE OF THE AIR

The temperature is the most important factor in the climate of a place. The following points must be taken into consideration: The mean annual temperature and the mean temperature for the different seasons and months of the year; the difference between the temperature in the sun and the temperature in the shade; the daily range of temperature at different seasons of the year; the liability of a locality to sudden irregular variations in temperature.

The temperature of a place depends chiefly on its degree of latitude. Other circumstances, however, besides distance from the equator help largely to modify it. Amongst these are: the altitude (the influence of altitude will be separately considered later on); the neighbourhood of seas and large surfaces of water or of high mountains, glaciers, and snow-fields; the humidity of the air, the nature of the earth's surface, and the prevalent winds.

Heat, from a climatic point of view, is practically all derived by radiation from the sun. To reach the earth's surface heat and light have to pass through the earth's atmosphere; this, if it were not for the water-vapour it contains, would allow all the heat to pass through it, and would, in fact, be as diathermic as space itself. As it is, a variable amount of heat is absorbed by the aqueous vapour (helping to warm the air) before it reaches the ground: much light and heat are kept back by clouds and mists when these are present. When they reach the earth's surface the rays of heat and light are partly reflected back again into the atmosphere and space, and partly absorbed, the light rays being transformed into heat. Thus it is that the earth's surface receives the supply of heat by which in turn it warms the atmosphere. The proportion of rays reflected to those absorbed varies with the nature of the surface, and in general terms the smoother and more nearly white the surface, the greater is the amount reflected. From chalky cliffs, snow-fields, glaciers, and sheets of water the reflection is especially great, whilst absorption is great when the soil is dark and dull or covered with green grass and dark foliage. A covering of snow during the long winter months prevents the soil from absorbing the sun's rays, and therefore greatly increases the heat in the sun and the cold in the shade.

The temperature in the sun and the temperature in the shade must be clearly distinguished. The latter depends mainly on the amount of heat given off from the earth's surface (a solid surface, or a surface of water, as the case may be), but at any one spot it may be altered greatly by any temporary currents of air there may be. Dry air allows the heat given off from the earth to pass through it much more easily than does moist air, and is therefore much less readily warmed. Hence in the dry climates of inland plains and high altitudes the difference between the temperature in the sun and the temperature in the shade is much greater than in the moist climates of the sea-coast. This great difference between the sun and shade temperatures is accompanied by a wide daily range of temperature, for when the air is dry and clear the heat stored up in the earth's surface during the day is rapidly lost by radiation into space during the night, so that, however hot and

bright the day may have been, the night tends to be cold. Since in cold weather the atmosphere cannot contain so much aqueous vapour as during hot weather, these characteristics of dry climates are more marked in winter than in summer: in some climates they can be observed only during winter.

When moist ocean winds have to pass over tracts of land, especially hilly or mountainous land, they part with much of their moisture, so that the climate of places situated more to leeward is drier and less equable. Norway and Sweden offer good examples of this; thus Buchan points out that whilst Hernösand on the eastern coast has an annual range of 42.5° F., at Aalesund, situated on the western coast, in the same latitude on the other side of the Dovre Fjeld Mountains, the annual range is only 18.4° F. Similarly in the British Islands, whilst Valentia, in the west, on the coast of Kerry, has a temperature range of only 16° F., that in the east, at Greenwich, is 26° F. The range of temperature increases generally in proceeding inland from the coast, both the *diurnal* or *daily range*, i.e. the difference between the maximum and minimum temperatures of the twenty-four hours, and what is generally but somewhat misleadingly called the *yearly* or *annual range*, i.e. the difference between the mean temperatures of the hottest and coldest months of the year.¹ An ample mean annual range of temperature is the most important characteristic of the so-called 'continental climates,' that is, the climates of inland plains of the temperate zones.² The mean annual range of temperature on the ocean shores is generally limited to about 20° F., whilst in the north-central parts of Asia it may reach 60° F. and even considerably more than 100° F. Within the tropics the mean annual range of temperature, even far inland, must naturally be relatively little. The 'absolute annual range' of temperature, that is, the difference between the actual maximum and minimum readings registered during the year (i.e. the mean absolute annual range of temperature for a period of many years), is from the climatotherapeutic point of view much less important than the 'annual range' (i.e. the mean annual range of temperature as above

¹ The mean range of temperature for a given period should be the difference between the mean of the daily maxima and the mean of the daily minima for that period. The absolute range of temperature for a given period is, of course, the difference between the highest registered daily maximum and the lowest registered daily minimum during that period. The term 'mean annual range of temperature' is, however, used by Hann in the generally accepted sense (*vide Handbook of Climatology*, by Dr. Julius Hann; English edition by R. de Coureay Ward, New York, 1903, p. 10).

² For examples of the differences between the mean monthly temperatures for January and July, showing great mean annual range of temperature, see the paragraph regarding typical 'Continental climates' in Chapter II.

defined). The (mean) daily range of temperature, other factors being similar, decreases in proceeding away from the tropical zones. In tropical inland plains the mean daily range is great owing to the extreme heating power of the vertical solar rays during the day, and the radiation of heat from the land during the night. The further we move from the tropics, however, the more slanting are the rays of the midday sun, and the feebler the heating power. In mountainous countries, other factors being alike, the mean daily range of temperature, as Hann and others point out, diminishes with elevation above sea-level. This applies to the sides of mountains, but in valleys even of high altitudes (and many high altitude resorts are situated in valleys) the reverse conditions hold good, for, as we shall explain in a later part of the volume, during the night the air over the mountain sides cools more rapidly than the air in the valleys, and the colder heavier air sinks downwards to take the place of the warmer air of the valleys, which is lighter and rises, thus diminishing the daily range of temperature on the mountain heights.

In regard to health resorts, however, it is the range of temperature for a particular season only with which physician and invalid are chiefly concerned.

We need not further consider here the general influence of proximity to the sea in diminishing the daily and annual range of temperature. The importance of the great ocean currents in modifying the mean annual temperature of the coast must, however, be mentioned. There are warm and cold currents in the ocean for the same physical reasons that there are in the atmosphere. Warm ocean currents flowing northwards from tropical regions warm the air over them, and thus modify the climate of the northern coasts they wash. The warm Gulf Stream, flowing from the Gulf of Mexico, has a great warming effect on the north-western coast of Europe against which it impinges, and to it the prevalent south-western winds of England owe their warmth and moisture. (On the Gulf Stream and its influence, see, however, paragraphs later on.) On the other hand, currents flowing from the Arctic and Antarctic regions exert an opposite effect. Thus, a cold ocean stream flowing southwards from Davis Strait has a chilling influence on the climate of the north-eastern coast of America.

The proximity of large inland lakes and surfaces of water has, like the proximity of the ocean, a certain tendency to make the climate humid and equable; but if, during winter, the surface becomes frozen, the sheet of ice thus formed will, of course, have a totally different effect on the range of atmospheric temperature. Buchan remarks that the curving round of the January

isothermals upon the regions surrounding the Baltic is to some extent due to the freezing of the shallow brackish waters of that sea during winter. Had the Baltic been deeper and saltier, and not subject to freezing, the winter climate of places round its coasts would have been much less severe.

A covering of moist grass and herbs, by the constant evaporation from its surface, tends in hot weather to lower the temperature of the superjacent air. Vegetation in general tends somewhat to modify temperature by increasing the moisture of the air.

The position of a place has an effect on its temperature by exposing it to or sheltering it from cold or warm currents of air, which may be of local or of distant origin. The sea-breezes on the coast, which have a most grateful and cooling influence during the heat of the day, will be referred to later on, as will be likewise the cold local currents of air which, in mountainous regions at night flow down the mountain sides into the valleys. Mountain ranges and ridges of hills cool the air and favour precipitation of its aqueous vapour; thus, as we have already pointed out, especially by depriving winds of much of their moisture, they modify the temperature of districts situated leeward, increasing the difference between the maximum and minimum readings of the thermometer. Cold icy winds sweeping down from the glaciers and snowfields of neighbouring mountain ranges may give rise to great and sudden variations in the temperature of a locality. Such winds, especially from relatively low mountains only covered with snow during winter, often constitute the chief drawback to the utility of health resorts which otherwise possess warm and sunny winter climates.

What has been said in the preceding paragraphs illustrates the fact that temperature—both the mean annual temperature of a place, and, especially important in regard to health resorts, the mean temperature for the various months and seasons of the year—is dependent on numerous conditions besides the mere distance from the equator. Alexander von Humboldt was the first to construct charts of the distribution of temperature over the surface of the globe. He connected places having the same mean annual temperature by ‘isothermal lines.’ Similar lines joining places having the same mean winter temperature and those joining places having the same mean summer temperature he termed ‘isoeimal’ (also called isoeimnal or isochimnal) and ‘isothermal’ lines respectively. Other observers made out isothermal lines for the different months of the year, and in regard to the choice of health resorts these ‘monthly isotherms’ are more important than the annual, summer or winter isotherms. Into the course of these isothermal lines, which are more regular

(and correspond more to the lines of latitude) over ocean than over continent, we cannot enter here.

The *effects of the temperature of the air* cannot easily be separated from those of the humidity, sunshine, winds, &c. The temperate zones are, of course, more conducive to health and longevity than are the Arctic regions and the tropics. Much, however, of the diseases and illnesses of tropical countries, formerly assigned to mere climatic factors, is now known to be caused by specific infectious diseases, and much is due to the unsuitable food and drink which residents in hot climates often indulge in. Many of these diseases are therefore only secondarily due to climate, and are, like similar diseases elsewhere, more or less preventable by general hygienic measures, or by great temperance in eating and drinking, with wholesome food and sufficient bodily exercise. On the whole, parasitic microbes (both saprophytic and pathogenic) grow best in hot moist places and least well in cold dry places. Moist heat and a high shade temperature have an oppressive effect on mind and body, and doubtless lower the resistance of the body to the invasions of pathogenic microbes. On the other hand, warmth favours rapid structural and functional development of the body in the young of human beings and animals alike, whilst cold delays the onset of puberty. It is notorious that menstruation tends to commence earlier and be more copious in tropical and subtropical climates than in temperate and cold climates.

In temperate climates we find deaths from certain diseases (such as infantile diarrhoea) specially numerous during hot seasons, and from other diseases (acute pulmonary complaints) especially numerous during cold seasons. The causes of death in the majority of these cases are more or less of microbic origin, but the temperature of the air has at least an indirect influence. During mild weather (moderately warm and not too damp) persons with chronic catarrhal affections, chronic muscular rheumatism, and rheumatoid arthritis often improve considerably, and patients with pulmonary emphysema and a tendency to bronchitis generally suffer less during warm and moist weather. Much depends on the constitution of the patient, those of strong constitution usually feeling better in cold weather, and those of weak constitution in warm weather. Dyspepsia and metabolic disorders (with a tendency to biliousness or gouty attacks) in persons of strong constitution, especially in those who have been inclined to eat too much, are often benefited by cold dry weather. In regard to the choice of climates, as well as in most other respects, aged persons are to be classed amongst patients of weak constitution. During the winter months the choice of a warmer

climate enables weak and aged persons to spend more time in the open air. Moreover, the diminution in distance from the equator—for instance, even in travelling from England to the Mediterranean coast of Europe—makes a difference in the length of day and the possible duration of sunshine.

Aged and feeble persons live best in equable and temperate climates, and support the extremes of heat and cold badly. A long spell of very cold weather always carries off an excessive proportion of old persons, who succumb chiefly to pulmonary complaints. For persons, however, of average strength, especially if they are natives of cold and temperate regions, a fair amount of cold weather is good. More heat is lost from the body in cold weather than in hot weather; to make up for the increased loss of heat, increased heat-production and increased metabolism are necessary, and thus greater activity of all the heat-producing organs and tissues of the body is required. This vital exercise may be too much for the old and feeble, for persons of originally weak constitution, and for those whose capacity for heat-production is lessened by permanent or temporary disease; in such cases the increased demand made on their vital powers may exhaust them and lead to depression of functions; but it may be of great use to corpulent and full-blooded individuals, whose organs require more exercise. In some persons also, especially those of sluggish reaction, the necessity for greater heat-production may act as a general stimulus to their vital powers, and make them more likely to resist infection; in some cases, e.g. chronic tuberculous diseases in certain individuals, even when the patient is already infected, moderate cold may, by stirring up the vital powers, exercise an indirectly beneficial effect on the disease. A considerable variation in the temperature and in the other factors of the climate helps to harden the body—that is, to render the powers of compensatory reaction of the organism more perfect; it favours activity, and is conducive to a high standard of development both of body and mind.

We will conclude this section with a short *summary of the main physiological and pathological effects* of atmospheric temperature.¹ The most important point is that cold renders greater heat-production necessary to keep up the body temperature, and therefore tends to increase metabolism, whereas continuous warmth has the opposite effect.² It is obvious, therefore, that,

¹ We cannot here discuss the highest and lowest temperatures which can be borne by different individuals and under various conditions, nor the bearing of atmospheric (natural and artificial) temperatures on industrial questions.

² For exaggeration of the lassitude and diminished metabolic vigour resulting from residence in hot climates, it does not seem that artificially cooled chambers

with other conditions the same, less food and less muscular exercise are necessary in hot weather than in cold weather. Cold climates are better suited for vigorous and plethoric persons and those who eat much, warm climates for those who eat little and whose powers of digestion, metabolism, and muscular exertion are deficient, whether such deficiency be due to past or present disease, old age, or some form of congenital or developmental debility. Cold air diminishes the tendency to pyrexia, as may be observed in sanatoria and hospitals for pulmonary tuberculosis where the open air treatment is carried out. Frequently cold weather produces 'chapped hands,' or roughness of the skin of the fingers (sometimes with troublesome little fissures), or chilblains; more rarely it causes or favours the onset of various skin eruptions or pruritus. The nurses and others constantly employed in the open air galleries of sanatoria for consumptives are, at all events in the English winter climate, particularly liable to suffer from chilblains. In some persons cold weather aggravates vasomotor disorders, such as a tendency to coldness, swelling, and lividity of the hands, or recurrent 'dead fingers,' and occasionally acts as an exciting cause of attacks of Raynaud's phenomena¹ (some minor forms of which resemble chilblains) or paroxysmal hæmoglobinuria. In these cases warm equable climates may be found useful. The effects of hot or cold weather depend greatly on the atmospheric humidity at the time. It is the combination of high atmospheric temperature with great humidity that is termed 'mugginess' in the subjective appreciation of the weather, to which we refer further on in speaking of a proposed classification of climates by the systematic registration of 'weather sensations.'

THE INFLUENCE OF LIGHT

We need not here enter into the great importance of light on the growth and development of plants. The influence of light and sunshine on the mind and general health of many persons is often remarkable. Some people become easily depressed in the absence of sunshine, and some of the bad effects both on body and mind of residence in dark dwellings of large towns may be due to the relative absence of light. John of Gaddesden, in Edward I.'s reign, used red wraps and red hangings for the beds and rooms of his small-pox patients, and claimed to have prevented

have been therapeutically employed like artificial warmth is constantly made use of in cold climates.

¹ Cf. S. Solis Cohen's views on vasomotor disorders as explained by him in his editorial additions to the volumes on Climatology in the *System of Physiologic Therapeutics*.

scars by this method.¹ In recent years N. Finsen and others have used red light for a similar purpose. The 'chemical' rays (those at the violet end of the spectrum which are excluded by red and orange glass) seem, indeed, according to the researches of Bowles, Finsen, &c., to exert a more irritating influence on the skin than the other rays; for certain purposes, therefore, and in certain morbid conditions, especially when there are acute cutaneous manifestations, they have as far as possible to be excluded; but their bactericidal action is probably greater than that of the other rays, and in chronic cutaneous affections they sometimes bring about a beneficial hyperæmic or inflammatory reaction. Finsen about 1895 introduced an ingenious method by which they can be concentrated either from sunlight or from electric light, and applied to the skin in the treatment of lupus vulgaris.² The 'chemical rays' of the spectrum are much absorbed in passing through the atmosphere, and there is quite conclusive evidence (see the section on High Altitude Climates in Chapter II) of the greater abundance of these rays at high altitudes. O. Bernhard, of Samaden, in the Upper Engadine in Switzerland, has made use of high altitudes to treat open wounds by exposure to sunlight.³

In observations on the effect of light (whether certain rays of the spectrum only or all the rays of sunlight be used) in diseased conditions of the skin, it is hard to say how much is due to the action of the light on the cells of the body, and how much to some antagonistic action on parasitic microbes. The antiseptic action, however, of sunlight on the microbes exposed to it in the air and elsewhere has been proved by the experiments of many investigators. Since, therefore, in the selection of a climate for therapeutic purposes, the purity of the air is always a main consideration, this effect of sunlight, though an indirect one as

¹ 'Deinde capiatur scarletum rubeum et involvatur variolosus totaliter vel in panno alio rubro, sicut ego feci de filio nobilissimi regis Angliæ, quando patiebatur istos morbos, et feci omnia circa lectum esse rubra. Et est bona cura. Et curavi eum in sequenti sine vestigiis variolarum.' Johannes de Gadesden. *Rosa Anglica*; the folio printed at Pavia in 1492, p. 51.

² Here we may allude to the mere warming effects of natural and artificial 'light baths' (all the rays included). Light rays seem to penetrate more deeply than heat rays, and even if in the tissues of the body all the light which penetrates becomes converted into heat, this power of deeper penetration is, perhaps rightly, adduced as one of the reasons for preferring the modern electric light ('radiant heat') baths to ordinary hot-air baths.

³ See 'Ueber offene Wundbehandlung durch Insolation und Eintrocknung, zugleich Einiges über Klimatische Einflüsse des Hochgebirges,' *Münchener med. Wochenschrift*, 1904, No. 1, p. 18. See also Saake ('Ein bislang unbekannter Factor des Hohenklimas,' *Münchener Med. Woch.* 1904, No. 1, p. 22) in regard to radioactive emanations in the atmosphere of high altitude localities; also *Physikalische Zeitschrift*, 1903, Vol. 4, No. 23.

far as the patient's body is concerned, can hardly be over-estimated. Amongst recent observers, Dr. Arthur Ransome has demonstrated the great value of light in regard particularly to the destruction of tubercle bacilli. In regard to the selection of winter climates for weak and aged persons, one must remember that diminution in distance from the equator—for instance, as we have already noted, even in travelling from England to the Mediterranean coast of Europe—makes a difference in the length of day and the possible duration of sunshine.

We need hardly discuss here the bad effects of too much sunshine in tropical climates, and the disagreeable effects on the skin (sunburn, &c.) and eyes¹ of too great exposure, especially when the sun's rays are reflected from glaciers and snow-fields. Nor need we stop to consider the harmful effects of ordinary light on the skin in the case of certain peculiarly susceptible individuals, e.g. hyperæmia and pigmentation, summer rashes, 'sun urticaria,'² 'sun erythema,' telangiectases, and the remarkable affection known as Kaposi's disease, or xeroderma pigmentosum. J. N. Hyde ('Brit. Med. Journ.,' Oct. 6, 1906, p. 833) suggests that want of light may be the cause of psoriasis in predisposed persons.

The duration of bright sunshine can be recorded daily by automatic methods, and thus the mean number of hours of sunshine, estimated by the same standard,³ can be calculated at all health resorts for the various months and seasons of the year. The duration of actual sunshine can further be compared with the duration of possible sunshine, and the former can be expressed as a percentage of the latter; by such figures also an idea of the frequency of cloud and fog at any place can be obtained. The Meteorological Office at London has published valuable tables giving the hours of actual sunshine at various localities in the British Islands, calculated from many years' observation. In Switzerland also the hours of actual sunshine have been tabulated for various stations by the Swiss Central Meteorological Institution, and data exist for other countries. The following summary is derived chiefly from Hann's 'Lehrbuch der Meteorologie.'⁴

The average total annual duration of sunshine in Europe varies from about 1,150 hours in the north of Scotland to about 2,900 hours at Madrid. The difference between these extreme figures is due partly to difference in cloudiness, partly to difference

¹ The conjunctivæ, like the skin of the exposed parts of the body, may be very susceptible to the glare of sunshine.

² For a remarkable case in which the eruption could be altogether prevented by cutting off the 'chemical rays' (interposing red glass) see S. B. Ward, *New York Medical Journal*, April 15, 1905, p. 742.

³ It must, however, be kept in mind that the figures obtained by sunshine recorders of the Campbell or 'burning' type cannot altogether satisfactorily be compared with figures obtained by instruments of the Jordan or 'photographic' type.

⁴ Second edition, Leipzig, 1906, p. 220.

in distance from the equator. The nearer a place is to the tropics, other conditions being alike, the greater is the amount of possible sunshine. For some patients this constitutes one of the advantages of winter health resorts in the south of Europe over places in the British Islands. For meteorological purposes the influence of the geographical position of a place can be evaded by expressing the actual duration of sunshine as a percentage of the possible duration. The Orkney Islands only receive 25 per cent. of the possible sunshine, whilst Madrid gets nearly 70 per cent. The average for the British Islands is 30 per cent., for Germany 38 per cent., for Italy 52 per cent. Dry, bright sub-tropical regions have still more sunshine: thus Kimberley, in South Africa, gets 74 per cent. of the possible sunshine (in the month of July even 85 per cent.), that is to say, 3,258 hours in the year. For the five months, November to March, Helouan, in Egypt,¹ gets 1,250 hours of sunshine, and Assouan doubtless gets more. The actual annual duration of sunshine may likewise be expressed in terms of the average number of hours *per diem*; thus Kimberley gets 8.9 hours a day, and Madrid 8.0; whilst Helouan, for the *five winter months* only, gets as much as eight hours a day. With increase of altitude the duration of sunshine mostly diminishes. On the summit of Ben Nevis (4,400 feet), in Scotland, the duration of sunshine is only 17 per cent. of the possible (747 hours) against 25 per cent. (1,105 hours) at its foot (Fort William). At the observatory on the Sonnblick (10,180 feet), in Tirol, the sunshine-duration is 34 per cent. of the possible against 40 per cent. in the lowland. On the other hand, mountain valleys at high altitudes, such as Davos and Arosa, in Switzerland, and Colorado Springs, in the Rocky Mountains of North America, may have more sunshine than the lowland plains, because of their freedom from clouds in autumn and winter. In fact, the relatively large percentage of the normal sunshine at high altitude mountain resorts is one of the chief characteristics of their winter climates. Large towns lose much sunshine owing to their smoke and fogs; thus, the City of London (Bunhill Row) gets only 23 per cent. of the possible amount, whilst Kew on its outskirts gets 31 per cent.; Hamburg gets 28 per cent., whilst the surrounding country probably gets 35 per cent. Thus, the difference in total annual duration of sunshine between a large town and the neighbouring country may amount to 7 or 8 per cent. of the possible sunshine, but the difference is much greater if we consider the colder months only. From November to February the City of London (Bunhill Row) gets only 96 hours, whilst Kew gets 172, and Eastbourne (on the south coast about

¹ W. Page May, *Helouan and the Egyptian Desert*, London, 1901.

60 miles to the south of London) gets 268. W. N. Shaw¹ estimates that owing to smoke and fogs London and Glasgow lose one-half of their proper share of sunshine (and presumably about the same fraction of their daylight) in winter and one-sixth in summer. Paris has suffered to some degree in the same way since coal has been extensively employed for its fires instead of wood.

According to the figures given in the publications of the London Meteorological Office, May is the sunniest month in Great Britain except for some of the southern stations. The following table (for which we are chiefly indebted to Mr. W. Marriott) shows that, whilst Hastings, in England, and Magdeburg, in Germany, obtain most sunshine in May, Aix-la-Chapelle (Aachen), Vienna, Davos, Montreux, Lugano, and Pola obtain most in July and August. Of these two months August is the sunniest at Montreux, and July at Aix-la-Chapelle, Vienna, Lugano and Pola, whilst at Davos the duration of sunshine is practically the same for both months.

DURATION OF SUNSHINE IN HOURS

	Hastings (1881-1900)	Magdeburg (1882-1896)	Aix-la-Chapelle (1897-1904)	Vienna (1881-1903)	Montreux (1893-1899)	Lugano (1896-1899)	Davos (1885-1900)	Pola (1885-1904)
January .	58.7	52	49.0	62	66.9	125.3	100.7	114
February .	83.6	73	66.3	84	95.3	147.9	111.8	135
March .	140.5	116	85.5	131	136.4	189.8	153.8	171
April .	173.5	164	132.6	174	170.5	181.6	164.0	210
May .	235.3	237	178.2	233	174.8	203.6	173.8	274
June .	227.8	222	192.2	239	191.4	253.2	177.2	296
July .	232.8	206	220.8	266	222.4	285.0	208.3	354
August .	211.7	192	202.0	241	234.5	283.4	207.1	327
September	167.7	157	135.2	180	163.0	210.5	171.4	234
October .	122.7	84	112.0	108	123.2	147.5	135.6	163
November	68.6	58	71.8	66	72.5	99.7	101.4	122
December	57.9	39	47.7	46	56.3	121.9	88.5	106
Year .	1,780.8	1,600	1,493.3	1,830	1,707.0	2,249.5	1,793.6	2,506

ATMOSPHERIC ELECTRICITY

Everyone is familiar with the electric discharges in the atmosphere manifested by lightning, and everyone knows that lightning may occasionally kill persons. In stormy weather the amount of ozone in the air may be increased, as it may be artificially by discharges from electric machines. Very little, however, is known in regard to the hygienic and climatotherapeutic significance of the electric conditions of the atmosphere. In mountain localities the air has apparently been found richer

¹ 'The Treatment of Smoke,' *Journal of the Sanitary Institute*, London, 1902, vol. xxiii. p. 318.

in radio-activity than in lowlands.¹ Some recent experiments tend to show that radio-activity may set free 'ions' in the atmosphere which can take the place of dust particles as 'condensation-nuclei' in the formation of mists and clouds.² Electric conditions may possibly act as determining factors in regard to the commencement of rainfall from clouds.

MOISTURE OF THE AIR

The amount of aqueous vapour which the atmosphere can take up before it becomes saturated depends on the temperature. The higher the temperature, the more water-vapour it can hold. Obviously, therefore, other conditions being similar, the amount of aqueous vapour in the air is likely to be greater in tropical regions than nearer to the poles, in hot weather than in cold weather, in summer than in winter, in the day than in the night. All the water-vapour in the atmosphere must be obtained by evaporation from the earth, and therefore it is likely to be especially abundant over or in the neighbourhood of large evaporating surfaces, such as the ocean, inland lakes, marshes, and districts rich in rivers, whilst it will be less plentiful over large dry inland plains and deserts. Other factors equal, the air over well-drained districts will contain less water-vapour than that over ill-drained districts. C. W. Buckley³ points out the great influence of geological formation upon the humidity of a locality, owing to the nature of surface and subsoil, and owing to natural drainage. He thinks that the strata most favourable to a low degree of absolute humidity are the impermeable rocks, namely carboniferous limestone, granite, &c.; that the next most favourable are the porous strata so far as they are free from clay, namely the new red sandstone and the chalk; that the carboniferous limestone is the driest formation. According to his views the soil and subsoil of a place have more influence on its atmospheric humidity than the amount of rainfall has. The position of a place is very important in this respect. Exposure on a plateau or windy slope may diminish the local atmospheric humidity by drying the soil; so may a sunny position on a southern slope. In large towns the pavements and impervious coverings of the soil, together with good drainage arrangements, may by artificially diminishing evaporation from the surface tend to lessen local atmospheric humidity, and thus diminish mists

¹ See Saake, *loc. cit.*

² See Lecture by C. T. R. Wilson at the Royal Institution, London, February 19, 1904. Wilson has detected radio-activity in freshly-fallen rain and snow.

³ 'Local Factors influencing Climate, with especial reference to Subsoil,' *Journal of Balneology and Climatology*, April 1903, p. 82.

and fogs. The diminution of local atmospheric humidity (including diminution of fogs) tends in its turn to increase the sunshine and warmth and to dry the ground. In Great Britain rainfall seems to rise with altitude, whilst atmospheric humidity falls. Buckley suggests that the bracing effects of some of the higher British resorts may be partly accounted for by the combination of great rainfall with relatively dry soil, the rain laying the dust and purifying the air, whilst the dryness of the soil lessens local atmospheric humidity. The greater movement of the air at elevated positions in England is likewise a factor tending to dry the soil.

The moisture of the air of a locality need not, however, at all times be due to local causes, but may be due to moist or dry currents of air coming from afar. Mountains and hills cause warm moist currents of air to precipitate their moisture, and places situated to leeward of mountain chains have a drier atmosphere than places situated to windward. This effect of mountain ranges on the humidity of the air is well illustrated in the cases of the Dovre Fjeld Mountains of Norway, the Andes of South America, the Western Ghats and Khasi Hills of India, and the great chain of the Himalayas; the same effect is shown by the difference in rainfall and humidity between the western and eastern parts of Corsica, between the western and eastern coasts of Great Britain, and, more strikingly, between the north-eastern and western sides of the island of Hawaii.

So far we have been considering the *absolute humidity* of the air; that is, the amount of aqueous vapour contained in a given volume of air. The *relative humidity* is the amount of vapour in a certain quantity of air expressed as the percentage of the amount which the same quantity of air at the same temperature and same pressure could possibly hold when completely saturated. The relative humidity must, therefore, always be considered with reference to the temperature. To emphasise this, S. E. Solly points out that if the relative humidity of air at 40° F. be 60 per cent., it will be only 10 per cent. when the temperature of the same air is raised to 80° F. It is obvious, therefore, that when the temperature has just fallen, the relative humidity will be generally greater than when the temperature has just risen. It is, in fact, generally greater during the night and early part of the morning than during the heat of the day.

When the air is saturated with moisture and the temperature is lowered, part of the aqueous vapour is condensed in the form of fine drops of water so as to give rise to dew, mists, clouds, rain, snow, or hail. The *dew-point* is the temperature at which the relative humidity of the air becomes so great that dew is deposited.

If the dew-point is high, the absolute humidity of the atmosphere is great, and there will be a tendency to the formation of mists and fogs. If the dew-point is low, mists and fogs will be scarce.

Precipitation takes place when moist air is cooled down to below its dew-point. It is thus that over moist soils and vegetation dew and mists and fogs have a special tendency to form in the night and early hours of the morning. Thus it is, too, that clouds and falls of rain and snow occur when warm moist air is chilled by contact with cold mountains or hill-tops, or by contact with cold currents of air. It has long been known and experimentally demonstrated that particles of dust in the atmosphere constitute nuclei on which, when the temperature falls to below the dew-point, the aqueous vapour condenses and forms the minute drops of water of which all *clouds, mists, and fogs* are composed. Some recent experiments also tend to show that radio-activity may set free 'ions' in the atmosphere which can take the place of dust-particles as 'condensation-nuclei.' Clouds are of great importance in regard to climate because they keep off the sun's rays and diminish radiation of heat from the earth. It is because of the frequency of clouds, fogs, and mists, that relatively cold moist climates have sometimes a depressing effect on the minds of persons who have been accustomed to and are fond of a clear sunny sky.

The amount of *rainfall* depends chiefly on the amount of evaporation from the surface and on the prevalent winds. Rain is therefore most abundant in tropical climates where there are large evaporating surfaces (the ocean) to draw on, but over the great Sahara desert there is no evaporation, and, as moist winds are heated by the dry hot sand, there is no rainfall, or scarcely any. Mountains, by their cooling effect, make moist air give up its moisture, and are the cause of the excessively great rainfall in certain districts where hills or mountains intercept moist winds. This accounts for the great annual rainfall in the Lake District of England. In the Western Ghats of India the annual rainfall may reach 300 inches at some spots. On the south-eastern slopes of the Himalayas the annual rainfall reaches several hundred inches. At Cherra Punji in the Khasi Hills there is said to be a rainfall of 600 inches. On the other hand, as already stated, by depriving warm moist winds of much of their moisture, mountain ranges exercise a drying effect on the climate of districts situated to their leeward. Striking examples will be adduced further on when discussing the influence of mountains on climate. The existence in some countries (notably in India) of distinct 'dry' and 'rainy' or 'wet' seasons depends on the prevalence at certain seasons of dry or moist 'seasonal' or 'periodic' winds. Great rainfall and

great humidity of air do not always accompany each other. Some districts with a fairly humid climate have very little rain, as, for instance, Lima in Peru, where it seldom rains (mean annual rainfall 9 inches), though the air is generally very moist; whilst some places with a large rainfall, but with a well-drained and rapidly drying surface, have a tolerably dry air.

A good deal of the prejudice against rain and snow appears to be unfounded. Showers of rain cleanse the air by removing impurities and dust. Snow during the time that it remains lying hinders the rising of dust and impure vapours from the ground; by reflecting light it increases the sun-heat and brightens the scenery, and by preventing the ground from becoming heated diminishes the local currents of air (day and night winds). Rain, by preventing the invalid from being much out of doors in the open air, may indeed constitute a serious inconvenience. The amount of time taken up by rainy weather is therefore of importance, and this does not necessarily correspond with the amount of rain. In tropical regions the rain falls in torrents, and, though the annual rainfall may be excessive, the time taken up by rainy weather may be less than in countries where much less rain falls. To quote H. Weber and M. G. Foster: 'It may even be said, with some exceptions, that the number of rainy days increases with the distance from the equator, while the amount of rainfall decreases.' From a medical climatological point of view, the number of rainy days and even the number of rainy hours are important, and in the selection of a health resort the season when it rains most frequently, and the hours of the day when the rain generally falls, should be ascertained, if possible.

Humidity serves to regulate the temperature of the air. If the air were really almost dry the nights would be excessively cold and the days excessively hot. When speaking of the temperature of the air, we have already alluded to some of the effects of a high or low degree of humidity. The degree of relative humidity is of great importance in all therapeutic classifications of climates. Solly says: 'In classifying climates as dry and moist, it is important to notice whether absolute or relative humidity is intended, and this must often be inferred from the connection in which the words are employed. Relative humidity is important in respect to the liability of the formation of fogs and dew, while physiologically the absolute humidity has often a greater significance. When statistics of relative humidity alone are given, it is necessary to take some standard temperature to make a fair comparison. Wendt computes the mean annual temperature of the United States as 55° F., which is probably nearly correct. Assuming, then, a standard temperature of 55° F.,

we can say that less than 50 per cent. of relative humidity is dry; from 65 to 75 per cent. is medium; from 75 to 85 per cent. is moist; and above 85 per cent. very moist.'

Solly goes on to point out that in estimating the value of the relative humidity the temperature should never be forgotten. On a sunny winter day with a shade temperature at noon of 40° F. a relative humidity of 70 per cent. would be very dry, and one above 90 per cent. very moist. On a summer day, however, with a shade temperature of 70° F., Solly considers a relative humidity of less than 30 per cent. very dry, and one over 70 per cent. very moist.

The absolute humidity of the atmosphere may be expressed as 'vapour pressure,' that is, as part of the total pressure of the atmosphere included in reading the height of the barometric column. It is more conveniently recorded as the number of grains of water contained in a cubic foot of air, or, better still (according to the metric system), by the grammes of water in a cubic metre of air. According to the observations of Dr. Chiaïs,¹ at Paris, either an absolute humidity of less than 5 grammes or one of more than 12 grammes in the cubic metre of air may exercise an injurious effect on man, acute affections of the respiratory organs being favoured by the excessively dry air, and metabolic and gastro-intestinal diseases by the excessively moist air.

In regard to the *physiological and pathological effects* of the moisture of the air, we will quote the following observations of Sir H. Weber:² 'The relative humidity has a particular relation to the skin, which, according to the degree of saturation of the air and its movement, yields up to it more or less moisture, and, owing to evaporation, more or less heat. If the air is moist, it is a better conductor of heat, but diminishes evaporation, the amount of wind being the same. By these conditions the skin is influenced in different ways. When the air is dry, the evaporation from the skin is increased according to the amount of movement in the air, and with evaporation a corresponding quantity of heat is lost. As a consequence, heat is much more easily borne when the air is dry than when it is moist, and more especially so if there is a wind blowing at the same time. In cold weather, when the air is dry, heat is also lost by evaporation; but this loss is not great, and may be much limited by clothing, unless there is a good deal of wind. When, on the other hand, the air is moist, the loss by conduction is much greater than in

¹ *Bulletin de l'Académie de Médecine de Paris*, November 7, 1899.

² In von Ziemssen's *Handbook of General Therapeutics*, English translation, vol. iv. p. 36.

dry air, and is considerably increased by winds. Hence, when a thaw sets in, the air is moist and frequently feels much colder, though it may be 20° or 25° F. warmer than during the preceding frost, when it was dry. This may partly account for the frequency of catarrhs when it is thawing and when the snow melts, though a still greater share in producing it must be attributed to the fact that the growth of micro-organisms is promoted in moist and comparatively warm air. Generally speaking, dry air is more bracing than moist air, and high temperatures, as mentioned above, are more easily borne in a dry than in a moist atmosphere; but dry air combined with very low temperatures irritates the respiratory organs and produces in them a tendency to inflammatory affections, particularly to pneumonia; whilst moist air combined with cold predisposes to catarrhs and bronchitis, and also to rheumatic and gouty affections.' On the other hand, moist air combined with warmth exercises a soothing influence on the mucous membranes, and the strain upon the constitution is less, but in many persons when exposed to it for a longer period the appetite has a tendency to fail, and the functions of the digestive organs and of the nervous system are apt to become impaired. This is the so-called 'relaxing' action of moist warm climates. A feeling of languor and a tendency to diarrhoea may arise even in healthy subjects, and there may be a generally diminished power of resistance towards harmful influences.

In comparing the relative drying effects on the body of cold climates and of hot dry climates, it must be remembered that a high relative humidity of cold air corresponds to a very low relative humidity if this cold air be heated up to the temperature of the lungs (about 99° F.), or to the temperature of the zone formed by the clothes surrounding the body (about 89° F.). It is, however, in the warm dry climates that this drying effect on the body can be made use of in the treatment of renal affections, the work required of the kidneys being doubtless diminished when the amount of water passing off from the skin and lungs is increased.

THE INFLUENCE OF ALTITUDE

The higher one climbs, the colder the climate becomes, until a level of perpetual snow is reached. The vegetation undergoes a change corresponding to that of the climate until it ceases altogether. For every 300 feet of altitude the atmosphere becomes about 1° F.¹ colder, and therefore the height above sea-level at

¹ This law is subject to many exceptions, due to local conditions.

which snow remains throughout the year varies in different countries, diminishing gradually as we pass from tropical regions towards the poles. On the mountain of Kilimandjaro, in Equatorial Africa, the snow-line is about 16,000 feet above sea-level; in Europe, on the Alps, it is about 9,000 feet; in the northern part of Scandinavia it is only about 3,000 feet, and in Spitzbergen it has descended to sea-level. It is obviously, therefore, impossible to classify climates into those of high altitude and those of low altitude by mere elevation above sea-level; the latitude or distance of a place from the equator must likewise be considered. Thus on Chimborazo, the lofty peak of the Ecuador Andes, the snow-line of which is about the same as that of Kilimandjaro, palms are said to grow at a level of 5,000 feet and wheat at 10,000 feet, which is an altitude above the snow-line of the mountains of Switzerland. In connection with the influence of the altitude of a place on animal and vegetable life, the elevation, configuration, and other features of the surroundings, and the prevalent winds, rainfall, and sunshine at different seasons of the year, are amongst the points requiring special consideration.

Other characteristics of high altitudes besides low temperature are:

1. *Low barometric pressure*, with consequent diminution in the density of the air, corresponding to the height of the place above sea-level.

2. *Dryness, great transparency and transalency, purity, and stillness* of the atmosphere. We shall, however, return to this subject in discussing the effects of climates of high altitudes (Chapter II).

ATMOSPHERIC PRESSURE

The pressure of the atmosphere at sea-level corresponds to that of a column of about thirty inches of mercury. It is, however, subject to more or less sudden change, and the average pressure varies somewhat at different places and at different seasons of the year. This can be demonstrated by charts in which the 'isobaric lines' are constructed after the manner of the 'isothermal lines.'

The higher anyone rises in the atmosphere, the less is the weight of the atmosphere which remains above one; and because the air is less compressed, it becomes less dense (more rarefied) the higher one gets. At a height of 16,000 feet a given volume of air contains only about half the amount of oxygen which it would contain at sea-level. To the physiological effects on the organism of rarefied air and low atmospheric pressure we shall return in Chapter II when discussing the therapeutic results of residence in climates of high altitude.

The atmospheric pressure depends on the temperature of the air and the amount of moisture which it contains. With increase of temperature the air expands and becomes lighter. Water-vapour is much lighter than air, and therefore a given volume of moist air weighs less than an equal volume of dry air at the same temperature and same pressure. A high temperature increases evaporation, and therefore when it occurs over a moist surface, such as the ocean, both heat and excess of aqueous vapour combine to make the air light and the atmospheric pressure low.

Everyone knows that when the barometric column of quick-silver falls, bad weather is threatened. It shows that the atmospheric pressure over the region of the earth's surface in question is diminished, because the average weight of the air above this region has become lighter. Whenever this happens the atmospheric equilibrium must be disturbed, for light air tends to rise and flow over in the upper and lighter parts of the atmosphere, currents of heavy air from surrounding districts flowing in to take the place of the ascending air. Moreover, the lightness of the air, as previously mentioned, is likely to be associated with excess of moisture, and when the ascending air reaches higher and cooler regions of the atmosphere the aqueous vapour will be condensed, and fall as rain or snow. Greater or lesser differences in specific gravity between different portions of the atmosphere give rise to various degrees of atmospheric disturbances ranging from gentle breezes to violent gales.

In order to explain this relation of atmospheric pressure to the *origin of winds and ocean currents* which affect the climates of the parts of the world with which we are concerned in the present volume, we append the following note kindly furnished us by Mr. W. Marriott, of the Royal Meteorological Society :

A great advance in our knowledge of the circulation of the atmosphere has been made during the last fifty years by the introduction of synoptic weather charts, which are now issued by the meteorological organisations of most countries. The charts show by lines the distribution of atmospheric pressure and temperature, and also by arrows the direction and force of the wind, over a large area. In order to secure comparability the barometer readings at all the stations are reduced to sea-level; and when these are plotted on the map, lines are drawn through the readings of the same value. These lines, which are called 'isobars' or isobaric lines, indicate areas of high and low pressure. When the arrows showing the direction of the wind are also plotted on the map, it is at once seen that they run nearly parallel with the isobaric lines.

In the areas of low barometric pressure, which are called 'cyclones,' the air moves round them in a circular, or rather spiral, direction opposite

to that of the hands of a watch ; while in the areas of high barometric pressure, which are called ' anticyclones,' the air moves round them in the direction of the hands of a watch. This circulation applies to the northern hemisphere ; in the southern hemisphere the circulation is in the opposite direction.

In the cyclonic systems the wind has a tendency to blow slightly inwards (in-flowing spiral systems), whereas in the anticyclones it has a tendency to blow slightly outwards (out-flowing spiral systems). If the isobaric lines are close together this indicates that there is a steep gradient, and consequently the winds are strong in force ; if, however, the isobaric lines are wide apart, the gradient is slight, and the winds are consequently light or calm.

In anticyclones the weather is generally fine and what is popularly described as of a ' settled ' character, the temperature is warm in summer and often cold in winter, there are frequent clear skies, and consequently considerable sunshine and comparatively little rain. In cyclonic systems the weather is of a different character, and as these systems generally move rather rapidly, we have what is termed ' unsettled ' weather, the temperature is cool in summer and mild in winter, there is a considerable amount of cloud, and consequently little sunshine and much rain.

Certain well-defined areas of high and low atmospheric pressure are formed over various parts of the world according to the season of the year. For instance, over the continents the pressure is higher in winter and lower in summer. This is most pronounced over Asia, where in the month of January a large anticyclone dominates the whole area, and so favours the production of intense cold over Siberia, &c. In summer the conditions are reversed ; for in July the continent is covered with a low-pressure system. This change from anticyclonic to cyclonic conditions completely alters the wind circulation, and so such seasonal winds as the dry north-east Monsoon and the moist south-west Monsoon of India are at once accounted for.

Over the Atlantic there is a persistent area of high pressure, which has sometimes been designated the ' Atlantic permanent anticyclone ' ; while in the north there is a low-pressure system, the centre of which is in the neighbourhood of Iceland. These conditions prevail more or less throughout the year, the Iceland cyclone, however, being most marked in the winter.

This distribution of atmospheric pressure is the dominant factor in the climate of North-west Europe, and is responsible for the prevailing winds in the British Isles being from the south-west.

The prevailing winds act upon the surface water of the oceans, and so become important factors in oceanic circulation.

The trade winds being from the north-east or south-east produce a general movement of the surface water from east to west along the equator. This coming in contact with islands on the coasts of continents is deflected north or south as a warm current.

'The Atlantic equatorial current may be said to divide on Cape St. Roque. One portion turns southward along the coast of Brazil and

flows on as far as the latitude of the River Plate, where it turns eastward across the South Atlantic. The other, and larger, portion passes northwards, and combining with the westerly current of the north-east trade, enters the Caribbean Sea, where it, in its turn, is embayed and turned back on itself. It finally flows forth from the Gulf of Mexico as a rapid stream—the Gulf Stream—which skirts the eastern coast of the United States throughout nearly its whole extent, and then sweeps across the North Atlantic to the shores of Northern Europe.¹ Not only are the prevailing winds the result of the distribution of atmospheric pressure, but such local winds as the Foehn, the Mistral, the Sirocco, &c., which will be referred to later on in the present chapter, are all due to the same cause combined with local features.

If the current of air has to pass over a range of hills it will have to rise until the ridge is reached, and in so doing it will be lowered in temperature (as the temperature of the air decreases at the rate of about 1° F. for every 300 feet altitude), and consequently its capacity for holding moisture will be reduced. If the temperature be lowered below the point of saturation or the dew-point, the air will have to part with some of its moisture in the form of rain. When the air descends on the other side of the hill it becomes warmer, and its capacity for moisture increases, so in fact it descends as a warmer and drier air. It will thus be seen that in the British Isles, where the prevailing winds are from the south-west, the western and most hilly parts of the country have the most rainfall, while over the leeward and eastern parts the rainfall is less.

The Effects of Variations in the Atmospheric Pressure in Man.—The effects of diminished atmospheric pressure will be considered under 'effects of high altitudes' in Chapter II. For the effects of increased atmospheric pressure we must refer readers to Paul Bert's well-known work (1878) and to the numerous recently published observations and investigations regarding 'caisson disease' and 'diver's paralysis.'² There now seems to be little doubt that diver's paralysis and other forms of caisson disease, are due to the setting free of bubbles of nitrogen (or at all events chiefly of nitrogen) in the blood-vessels of the spinal cord and elsewhere when the atmospheric pressure is too rapidly reduced.

¹ *Elementary Meteorology*, by Robert H. Scott, 1883, p. 297.

² Amongst recent literature on the subject see Leonard E. Hill, 'Influence of Atmospheric Pressure on Man,' *Lancet*, 1905, vol. ii. p. 1; Hill's contributions on this subject in *Recent Advances in Physiology and Bio-Chemistry*, edited by L. E. Hill, London, 1906; Hill and J. J. R. Macleod, 'Influence of Compressed Air,' *Journal of Physiology*, 1903, vol. 29, pp. 382 and 492; M. Greenwood junior, 'Influence of Increased Barometric Pressure on Man,' *British Medical Journal*, 1906, vol. i. p. 912; E. H. Snell, *Compressed Air Illness, or so-called Caisson Disease* (with bibliography), London, 1896; R. Heller, W. Mager and H. von Schrötter, *Luftdruck-Erkrankungen mit bes. Berücksichtigung der sog. Caissonkrankheit* (with bibliography), Vienna, 1900. Regarding the effects of the therapeutic use of compressed air baths, see the older writings of Von Vivenot and G. von Liebig; also P. L. Tissier's account of 'pneumatic chamber' methods in Solis Cohen's *System of Physiologic Therapeutics*, vol. 10, 1903.

MOVEMENT OF THE AIR

All movements of the air, whether gentle or violent, local or of great extent, are due, as previously explained, to differences in the specific gravity of different portions of the atmosphere, and are thus indirectly due to temperature and degree of humidity.

Amongst local winds, familiar examples are the diurnal and nocturnal breezes of the seashore and mountain valleys. Water is continually losing heat by evaporation from the surface, and the sun's rays penetrate more deeply into water than into soil. Hence during the day a surface of water is more slowly heated than a surface of rock or soil, and during the night, owing to the laws of convection and radiation, a surface of water is much less readily cooled. During the day, therefore, when the shore is hotter than the sea, the warm air above it rises and the cooler air from over the sea flows in to take its place, giving rise to the familiar sea-breezes of sea-side places. Exactly the opposite occurs during the night. The land cools down more quickly than the sea, so that the heavier air over it moves out seawards (land-breeze) to take the place of the warmer and lighter air over the water.

In mountain valleys the diurnal current of air generally moves upwards from the valley (called the 'valley wind' or 'morning wind'), and the nocturnal one (the 'mountain wind' or 'evening wind') downwards. The reason for this is the following: In the morning the slopes get heated earlier than the lower parts of the valley, and consequently the colder air from below streams upwards to take the place of the warmer air rising from the heated slopes. In the evening and night radiation is less rapid, and the air is warmer in the depths of the valleys than higher up; consequently the cold air streams down the sides of the mountains and down the valleys to take the place of the warmer air, which tends to rise because it is lighter. A site some way up the side of a valley is likely to be less affected by these local winds than one in the depths of the valley is. In a few mountain valleys the local winds move in a direction contrary to the rule. Thus, the morning wind blows down instead of up the valley of the Upper Inn (Upper Engadine) during the warmer months, though in the side-valleys the morning winds blow upwards in accordance with the rule. Billwiller and others have shown that this exception to the rule confirms instead of disproves the theory of local mountain winds, and is due to the fact that the Upper Engadine is not inclosed at its upper end, and that on the further side of the Maloja Pass, which is but little higher than the valley-floor itself, is the head of the deep and well-warmed valley of the Mera

(Upper Val Bregaglia or Bergell), the air of which rises above the level of the Maloja Pass and descends the Upper Engadine Valley.¹

We will now proceed to general winds which are connected with the fundamental circulation of air over the globe.

The heat and evaporation caused by the perpendicular rays of the sun give rise to a belt of low atmospheric pressure in tropical regions (north of the equator in summer, south of the equator in winter), where currents of light air are continually ascending. Currents of heavier air flow in from belts of higher atmospheric pressure on either side of the belt of low pressure to take the place of the ascending air. These are known as the 'trade winds,' and owing to the rotation of the earth from west to east, the trade wind of the northern hemisphere is a north-eastern wind, and that of the southern hemisphere is a south-eastern one.

The ascending air of the tropical belt when it reaches the upper part of the atmosphere divides, and some of it flows northwards, some of it southwards. These currents, moving in the upper regions of the atmosphere away from the equator, when they arrive at the belt of high pressure descend and reach the surface in temperate latitudes. Some of the air then flows back towards the equator, and some travels onward towards the poles. This latter portion, in the northern hemisphere, owing to the effect of the earth's rotation, takes a north-eastern direction, and thus the familiar south-western wind of England is accounted for.

We will now consider some of the important winds which blow almost exclusively at certain seasons of the year. Typical examples of these are the summer and winter winds, known as Monsoons, on the shores of the Indian Ocean. In winter the pressure of the air is high over the elevated cold table lands of Central Asia, and from this centre the cold heavy dry air streams out in all directions and passes over India towards the ocean. In summer the process is reversed. The centre of Asia is heated by the summer sun, the air over it becomes lighter and rises, and currents of cooler air stream in from every side. The direction of the prevalent winds connected with this great periodic movement varies, of course, in different countries according to the position of the country with reference to Central Asia. The seasonal easterly and westerly winds over the western part of Europe are connected with the Asiatic system. The great periodic differences of rainfall, which are so important a characteristic of many climates, are chiefly connected with the periodic variations in the direction of the prevalent winds.

¹ See Hann's *General Climatology*, English translation by R. de Courcy Ward, 1903, p. 336.

Various local winds of different countries are of importance from the point of view of medical climatology. The disagreeable character of some of these winds often constitutes a serious drawback to the climate of otherwise admirable health resorts. 'When they come from tracts where the pressure is high and the temperature low, to where the pressure is lower and the temperature higher, they are felt as cold blasts, whereby the humidity of the air in the low-pressure area is condensed into torrents of rain. One of the best known examples of such a wind is that known as the Mistral, which descends from the high plateaux and plains of Central and Eastern France, and is felt as a cold and sometimes tempestuous wind along the shores of the Mediterranean.¹ When a low atmospheric pressure happens to arise on the borders of a hot desert region like those of Africa, Arabia, or the interior of Australia, it draws in towards it the hot air lying over the burning sands, which in the countries where it blows is extremely unhealthy. In Italy such a wind is known as the Sirocco—a hot moist wind which raises a haze in the air, and produces a sensation of extreme languor both in man and beast.² In Spain, where it receives the name of the Solano, it sometimes comes across the narrow part of the Mediterranean laden with fine hot dust from the vast African deserts. In Africa and Arabia it appears as the dreaded Simoom—a hot suffocating wind, which sometimes rushes across the desert with such violence as to raise clouds of sand and sweep them in whirling masses for many miles. It thus heaps up vast mounds of sand, under which caravans of travellers may be completely buried. One of the armies of Cambyses, 50,000 in number, is said to have been engulfed in the sand when on its way to attack the oasis and temple of Jupiter Ammon. Again, on the coast of Guinea during December, January, and February, a hot wind called the Harmattan blows from the interior out to sea.³ The Khamseen in Egypt is a similar wind; the word means fifty, and it derives this name from its frequent occurrence during the fifty days between the Coptic Easter and Pentecost, between the end of February and the end of April. It is a dry south or south-west wind lasting two to four days, and bringing clouds of fine sand with it from the desert. This dust not only obscures the sun like a dense fog, but irritates the eyes and nasal mucous membrane, gets into the clothes, and penetrates into closed rooms.

¹ The Mistral most frequently occurs in February, March, and the beginning of April. It is a dry and violent wind, raising clouds of dust, and is very chilling, often even when the sun is shining brightly.

² In Sicily, and especially in Palermo, the Sirocco (or Scirocco) is much feared. It is a hot south or south-east wind, which may be moist or dry according to the amount of moisture it has taken up in crossing the Mediterranean Sea.

³ Sir A. Geikie's *Physical Geography*, London, 1894, p. 94.

During spring the Khamseen is a very hot wind, the thermometer rising, according to Canney, to 100° or even 108° F., but when the south or south-west winds occur at Cairo in autumn and winter they are colder (cold Khamseen). In the north-west provinces of India there are hot winds described as sometimes producing violent whirlwinds, which sweep up the dust and carry it in whirling columns into the upper air, whence it gradually finds its way to the earth again.

The Foehn of Switzerland and the Alps is a warm and dry southerly or south-easterly wind, appearing with particular violence in the north-eastern portions of the Alps, chiefly from late summer to spring. According to Wettstein (quoted by de la Harpe), out of 40·9 days on which the Foehn blows in Northern Switzerland, 9·1 are in winter, 17·3 in spring, 4·9 in summer, and 9·6 in autumn. The characteristic warmth and dryness of the Foehn have been explained by its being a 'falling wind,' a current of air descending from higher regions of the atmosphere from over the mountains. When air descends to regions of greater atmospheric pressure it must, by the established laws of physics, become denser, occupy less space, and gain in temperature and in capacity for holding aqueous vapour. In fact, such descending air would be warm and of low relative humidity, like the Foehn is. De la Harpe¹ points out that this wind is limited to the Alps, from Geneva to Salzburg, but over this region is of very great climatic importance. It is chiefly felt in valleys having a south and north direction. Thus it blows along the Rhone Valley from Martigny to the Lake of Geneva, reaching Montreux and even as far west as Lausanne. Its violence is greatest in the more elevated and narrow portions of the valleys, where it sometimes tears out trees and blows down huts. Owing to its dryness and warmth, one day of the Foehn may melt as much snow as two weeks of sunshine. This wind helps grapes to ripen in autumn, and its influence accounts for the growth of chestnut trees about the Lake of Lucerne. When it blows in winter, the thermometer may rise to the summer level. It diminishes the relative humidity of the air (driving clouds away), but is often followed by rain, owing to subsequent cooling of the air to below the point of saturation. The Foehn wind is accompanied by a fall of barometric pressure, and reasons adduced by Hann and others make it appear that a very localised fall of barometric pressure is the real cause of the wind, and that local winds, analogous to the Foehn, occur in other mountainous regions besides the Alps of Europe. The studies of Erk, Billwiller, and Pernter show, according to Hann, that besides the larger

¹ *La Suisse Balnéaire et Climatique*, second edition, Zürich, 1897.

barometric depressions which usually pass on the western or north-western side of the Alps, local barometric depressions also occur, with 'cyclonic systems' of their own (see remarks further on in this chapter), along the northern border of the Alps and in the Alpine valleys themselves, and that these are the immediate cause of the Foehn. This explains the local violence and frequency of the Foehn in the Eastern Alps, especially at Innsbruck, in apparent disregard of the general distribution of barometric pressure.¹ The old idea that the Foehn is a wind from North Africa, owing its warmth and dryness to a Sahara origin, is of course quite given up. The effect of the Foehn on patients and even on healthy persons is depressing.

Winds are great distributors of temperature and moisture over the surface of the globe. Some winds bring rain and clouds, and others bring dry weather. In some places the periodic alteration in the direction of the prevalent winds is sufficient to give rise to alternating dry and rainy seasons, which contrast strongly with each other. By preventing stagnation of the air, winds hinder the accumulation of organic and inorganic impurities at all spots to which they can gain access; they thus, together with rain and light, act on the whole as purifiers of the atmosphere, though some of them may bring with them disagreeable dust, organic impurities, and even pathogenic microbes. Living micro-organisms when carried about by winds are, however, soon likely to be destroyed by the effects of exposure to light, &c.

By the evaporation they cause, and (in the case of moist winds) by the heat-absorbing qualities of their moisture, winds have a chilling effect on the body, which when at all excessive may hinder invalids from being sufficiently in the open air. Winds bringing constant rain and dust likewise prevent persons from being sufficiently out of doors. On the other hand, cool breezes, such as those usually present along the sea-coast, have a most grateful and refreshing influence in hot weather. Such moderate movements of the atmosphere, by withdrawing heat from the surface of the body, gently stimulate the metabolism and thus exert an indirect beneficial effect on the various organs of the body. The quantity or force of wind which invalids can stand depends on their previous habits and other factors modifying their individual powers of reaction.

In regard to health resorts the character and amount of the local and general winds should always be investigated; so also the times of day and the seasons of the year at which they are prevalent; whether their occurrence is fairly constant or subject

¹ See Hann's *General Climatology*, English translation by R. de Courcy Ward, 1903, p. 354.

to great and unforeseen irregularities; and whether they give rise to sudden variations in temperature and humidity and are accompanied by clouds, precipitation, or dust. The relative amount of shelter obtained at the different sites in the neighbourhood is, of course, most important.

A. Haviland and others have shown that regions exposed to high winds tend to have a greater mortality from pulmonary tuberculosis than the more sheltered districts in the neighbourhood. In other words: High winds increase the mortality from phthisis. This fact can be explained (1) by the inhabitants in windy districts preferring to live in stuffy rooms, with their doors and windows kept shut; and (2) by the injurious influence of high winds often noted in persons not suffering from any actual disease, but commonly observed in individuals of feeble constitution and in those predisposed to bronchitic affections. Shelter from winds is therefore a most important consideration in the selection of a site for the sanatorium or open-air treatment of consumptives. W. Gordon, who has investigated the influence of winds on phthisis in Devonshire¹ and in general,² comes to the conclusion that it is specially the *strong rainy winds* (in Devonshire the west and south-west winds) which are harmful. This, he thinks, is possibly explained by their chilling and depressing effects, and by their tendency to excite bronchial catarrh in persons exposed to them.

THE NATURE OF THE SURFACE, SOIL AND SUBSOIL, ASPECT, SURROUNDINGS ETC. OF A PLACE OR REGION

The influence of the soil on the climate and health of a district needs very little discussion. The relation of the geological formation of a locality (*owing to the nature of the surface and subsoil*) to the humidity of the air has been already referred to. Micro-organisms seem to preserve their vitality best in moist air and in districts with a damp badly drained soil. Malaria, which a generation back was prevalent in certain parts of England, has been banished by the drainage of the fens and marshes, that is to say, by the removal of the pools and collections of stagnant water used as breeding places by the intermediate hosts (mosquitos of the 'Anopheles' kind) of the malarial parasites. Bowditch, Buchanan, and others have shown that drainage of wet ground may have a decided effect in diminishing the mortality from other microbic disease such as tuberculosis. A damp soil and the

¹ *British Medical Journal*, January 12, 1901, p. 69; May 23, 1903, p. 1189; and January 14, 1905, p. 62; also (with J. R. Harper) *Brit. Med. Journ.*, Nov. 3, 1906, p. 1165.

² 'The Influence of Rainy Winds on Phthisis,' *Lancet*, January 7 and 14 1905.

neighbourhood of marshy ground and stagnant water, according to general observation, favour a tendency to chronic rheumatism and rheumatoid arthritis, though the exact connection between the dampness and the morbid conditions is not quite apparent.

Owing to evaporation the air over wet ground is colder than over dry ground, and the mean temperature of the land has been found by Buchan to be somewhat raised by drainage. The relative coldness and the prevalence of mists and fogs, together with the consequent diminution of sunlight, may be responsible for some of the bad effects which might otherwise be attributed to mere dampness of the soil. The fogs, especially the 'black fogs' of London and great or peculiarly smoky towns, owe their special effects to the irritating particles of dust on which the aqueous vapour has condensed; the dust particles, weighed down by the adherent water, sink to a low level of the atmosphere, and are thus inhaled in much greater numbers than ordinarily. The loss of sunshine owing to town fogs is greatest during the colder months of the year, and greatly affects the autumn and winter climates of large towns. From November to February the City of London (Bunhill Row) gets only 96 hours of sunshine, whilst Kew gets 172. Similar losses are shown by the records in other large towns, such as Glasgow, Hamburg, &c. (see the section on the 'Influence of Light' in an earlier part of this chapter). W. N. Shaw¹ estimates that owing to smoke and fogs London and Glasgow lose one-half of their proper share of sunshine (and presumably about the same fraction of their daylight) in winter and one-sixth in summer. In regard to the total annual duration of sunshine the records of large towns, like London, Glasgow, and Hamburg, show, according to Hann, that they get 7 or 8 per cent. of the possible time less than the neighbouring country.

For many persons it is important that the ground be dry and permeable (sandstone), and that a site be chosen on a slope, where drainage is naturally facilitated. Much, however, can be done by artificial sanitary arrangements to render a somewhat unsatisfactory site healthy. In London and its suburbs the cutting down of trees, drainage of the soil, and covering of the ground by impervious cement or pavement, have suppressed a great deal of the mist formerly due to surface moisture, and the growth of the town has therefore had some influence in diminishing the fogs for which London is notorious.² The accumulation of buildings causes some difference between 'city-temperatures' and

¹ 'The Treatment of Smoke,' *Journal of the Sanitary Institute*, London, 1902, vol. xxiii. p. 318.

² See Dr. W. Ewart's Report on London in *The Climates and Baths of Great Britain*, London, 1902, vol. ii. p. 33.

readings obtained simultaneously in the open country near by. This was illustrated many years ago by F. Renou in comparing temperatures taken at the Observatory of Paris with those taken simultaneously at Choisy-le-Roi, and it forms one reason why observatories should be situated near, instead of, or as well as, in large towns. According to J. Hann, as a general rule it is found that the mean annual temperature of the air in places where there are many buildings is from 0.5° to 1.0° Celsius, that is, up to 1.8° Fahrenheit, higher. The differences are greatest in the morning and evening, and least at noon. The daily range of temperature is smaller in cities than in the open country, especially in summer.¹

When the ground is covered by vegetation, as in pasture land, the grassy covering prevents the soil from being so readily heated by the sun's rays as in the case of bare sand. This circumstance and the constant evaporation from vegetation render the air above it cooler and moister. Thus, in taking the temperature over a tract of arid sandy soil and over meadow land beside it, Sir H. Weber has found a difference of more than 30° F. (when, however, the grass is dried up the difference is, of course, much less). Radiation at night is much greater on meadow land in consequence of the large radiating surface and sharp points afforded by the blades of grass. Thus, after sunset, rapid cooling of the surface and the air about it takes place, and there is frequently a precipitation of mist, dew, or hoar frost. Leigh Canney² found that the temperature over a cultivated area in Upper Egypt fell to the freezing point seventeen times in January and February, when the temperature of a spot half a mile distant on the roof of a hotel only fell to 38° F. on one occasion. He found also that the relative humidity was 13.7 per cent. higher during the day in the cultivated fields than in the neighbouring desert, and during the night the difference was still more marked (about 40 per cent.). The influence of forests on climate will be referred to later on.

In winter time, when the meadows are covered with snow, and when the marshy land as well as the whole soil is frozen, the presence of vegetation and stagnant water, of course, no longer or much less affects the temperature and humidity of the air. A covering of snow, as already mentioned, hinders the rising of dust and impure vapours from the ground; it reflects light, and (in clear weather) increases the brightness of the scenery and the warmth of the sun; and, by preventing the ground from becoming heated, it diminishes the local currents of air.

¹ See Hann's *General Climatology*, English translation by R. de Courey Ward, 1903, p. 29.

² *Winter Meteorology of Egypt*, London, 1897.

The situation of a locality in regard to sunshine and shelter from winds is important. In a mountainous district most light is obtained on southern slopes (in the northern hemisphere), whereas at the bottom of deep valleys, and in certain positions with regard to hills and mountains, a great part of the daily sunshine may be cut off by the neighbouring heights. Moreover, owing to more sunshine, ventilation, and natural drainage, localities on southern slopes (i.e. in the northern hemisphere) often have drier soils than those situated in the bottoms of valleys. The important connection between the position of a place, the dryness of the soil, and the degree of atmospheric humidity, has already been referred to. In some mountainous and hilly situations the light may be very much increased by reflection from white chalk cliffs, bright sandstone surfaces, snowfields, &c. During the heat of summer an aspect away from the sun (i.e. towards the north, in the northern hemisphere) is preferable for many persons.

We will now shortly consider the influence of woods and mountains on climate, especially in regard to winds, moisture, and rainfall.

In regard to the influence of forests, the main facts or tendencies may be shortly summarised as follows. The ground in a forest is some degrees colder, and the ground and the air are moister, than elsewhere. There is less difference between the day and the night temperatures. Rain is more frequent. The ozone of the atmosphere is said to be increased. The trees diminish the movement of the air, and likewise cut off some of the light. In forests of pine the above-mentioned characteristics, which have been notably studied by E. Ebermayer, are less marked than in forests of deciduous trees, and in the latter are naturally less noticeable in winter than in summer when the trees are in foliage. There are doubtless other modifications in forest air which have not been exactly determined, possibly in part due to the effect of the active chemical changes taking place in the leaves. The exhalations from the trees and shrubs must likewise be considered in regard to the influence of forest air, and in pine forests the aromatic substances given off may possess an antiseptic influence. A forest or clump of trees in the desired direction may form a valuable protection from local or general winds. On mountain slopes a clump of trees, as H. Weber has observed, may be sufficient to shelter the part of the slope below the trees from the chilling effect of the cold currents of air which stream down the mountain sides at sunset.¹

Mountains exercise a great influence on climate according to their height, their size and shape, and their position in regard

¹ On the whole subject of the Influence of Forests on Climate, see Chapter XI. in Hann's *General Climatology*, English translation by R. de Courey Ward, 1903, p. 192.

to the prevalent winds. They intercept or alter the direction of winds, and modify the character of the latter by withdrawing moisture and altering temperature. The amount of their influence depends on the completeness of the shelter they afford a place, and whether they shelter it from cold or hot winds and from dry or moist winds. When covered with glaciers and snowfields, mountains may themselves be the source of cold currents of air which stream down the slopes and valleys and have a very chilling effect on the adjoining districts. When warm moist winds come into contact with hills and mountains their temperature is lowered, and consequently much of their aqueous vapour is precipitated as rain or snow. When warm moist winds from the ocean come into contact with a mountainous coast region the precipitation is, of course, peculiarly great. This explains the excessive rainfall in the Lake District of England and in parts of the north-west coast of Scotland, where the warm and moist south-westerly winds from the Atlantic meet with a mountainous coast and discharge their moisture. This also explains the excessive wetness (i.e. rainfall) on part of the mountainous western coast-land of Norway. In India the warm moist monsoon blowing from the Indian Ocean over the range of the Western Ghats yields a very heavy rainfall, amounting on the summits of the range to about 260 inches annually. In such cases the country lying to the leeward of the mountains often gets comparatively little rain. Thus Poonah, lying to the eastern or lee side and close to the foot of the Western Ghats, has a rainfall of only about 30 inches. Similarly, the warm moist wind (south-west monsoon) coming from the Bay of Bengal yields an immense amount of rain in passing over the Khasi Hills and the Himalaya Mountains, and to the north of this range passes over the plains of Thibet as a cool dry wind. The Island of Hawaii, over which the moist (north-eastern) trade winds blow, affords a most striking example of the effect of mountains in determining the distribution of rain. Hardly any rain falls on the western coast of the island, which is to the leeward of the great mountains, whereas to the windward on the north-eastern coast and uplands the annual rainfall reaches 100 to 230 inches.

The neighbourhood of the sea and of large inland lakes modifies the climate by rendering it more humid and more equable. They likewise give rise to local diurnal and nocturnal breezes, as already explained. It is the perpetual movement and purity of the air, its moisture and the presence frequently of salt-water spray, which constitute the climatic features of a coast-line exposed to the open sea. This subject will be further considered in Chapter II under 'Marine Climates.'

CHAPTER II

CLASSIFICATION OF CLIMATES AND CHARACTERISTICS OF THE
DIFFERENT CLASSES

CLIMATES may be classified by latitudes or by isothermal lines, by the mean annual temperatures, or by the mean temperatures for summer or for winter, or for the season during which a climate is made use of for medical purposes. The relative humidity has been used as the basis of classification by many authors. A disadvantage of employing a classification based on therapeutical effects is that a climate which for one person is tonic, bracing, or exhilarating, may by another person be found sedative, relaxing, or depressing. If a nomenclature of this kind be employed, it should, of course, be founded on what is believed to be the usual effects of the climates or health resorts in question on the majority of individuals, especially on persons without much disease.

W. F. Tyler has suggested¹ a method of classifying climates according to their average effect on the subjective condition of a number of observers. As is well known, the temperature and humidity of the atmosphere exercise a joint effect on the sensations and capacity for physical and psychical effort, an effect which is described as tonic or sedative, bracing or relaxing. Tyler thinks that the regular registration of these sensations, according to a subjective 'climatic scale,' might give valuable results in regard to the comparison of climates. Great caution, however, is needed in accepting sensations as an index of atmospheric conditions. It must be remembered that to get a reliable average a great number of persons would have to be engaged in such investigations. Moreover, although the state of the weather does undoubtedly influence one's feelings, some persons are much more readily thus affected than others, and some persons with chronic arthritic disorders probably possess an unenviable and excessive 'hygic sensibility.' Much also depends on temporary states of the digestive system. After a heavy meal weather may be found relaxing and depressing which on a spare diet would have been found quite pleasant if not bracing.

All methods of classification present great difficulties, but we shall here adopt the following scheme, which is similar to that

¹ 'A Scheme for the Comparison of Climates,' *Journal of Balneology and Climatology*, London, February 1904.

employed by Sir H. Weber in his work on 'Climatotherapeutics' ¹ for Ziemssen's 'Handbook of General Therapeutics.'

I. Sea and Coast Climates.

II. Inland Climates.

A. Of High Altitudes.

B. Of Moderate and Low Altitudes.

By this method we get three main divisions, which are very convenient from the medical point of view, and admit of certain further subdivision being made. Thus, amongst marine climates the comparatively drier health resorts, such as those of the Western Riviera, may be separated from moister marine localities, such as Funchal in Madeira; amongst inland climates of low altitude, the dry subtropical desert climates, such as those of Upper Egypt, form a special group in themselves.

We shall now consider the characteristics and the physiological and therapeutic effects of the various classes of climates.

SEA AND COAST CLIMATES (MARINE CLIMATES)

During the day the sun's rays penetrate the water deeply, and the total heat absorbed is greater than that on land, but, as we have already pointed out, the surface of the sea, owing to the continual loss of heat by evaporation, does not get so readily heated as the land. During night, however, as soon as the uppermost layers of water get cooled, their place is taken by the warmer layers beneath them, and thus by convection the surface of the sea maintains its warmth better than the surface of the land. Moreover, radiation from the sea into space is checked by a layer of vapour. All this serves to explain one of the most important characteristics of sea air—namely, its equability.

Besides equability, the chief characteristics of a purely marine or ocean climate (that is, the climate met with on an ocean voyage) are, the tolerable degree of humidity, the abundance of light, and the freedom from dust, microbes, and other impurities. The mean relative humidity on the open ocean is $73\frac{1}{2}$ per cent. of saturation, and the air is generally less moist than at most seaside places. The midday temperature is seldom above 85° F. The sea breezes are refreshing, and heat on the ocean is less complained of than it might be at the same temperatures on land; even within the tropics it is seldom found to be very oppressive, excepting during total absence of wind. Besides the therapeutic effects of ocean air, the mental rest during a long voyage and the change of surroundings must likewise be taken into account, but we will return to this subject when dealing with ocean voyages.

¹ English translation by Dr. H. Port, London, 1885.

Climates of coasts and small islands.—These climates have more or less in common with the purely marine climate of the open ocean, but differ much amongst themselves according to distance from the equator, the prevailing winds, configuration of the coast, &c. Small islands in the midst of the ocean, such as the Scilly Islands and Heligoland, have a climate almost purely marine. The small Monach Islands (latitude of the lighthouse $57^{\circ} 32'$ north), in the Outer Hebrides, are so much under the influence of the Atlantic and the warm Gulf Stream that, as Buchan points out, they have warmer winters than Ventnor (latitude $50^{\circ} 34'$ north) in the Isle of Wight, though their summer temperature is, of course, lower. On the other hand, the climates of the Mediterranean and Baltic coasts are modified by their positions in regard to the neighbouring lands, and thus differ greatly from the climates of the open western coast of Europe.

Generally speaking, coast climates, like ocean climates, are characterised by purity of air and by greater humidity and equability than inland climates. According to the force of the waves and the character of the shore, the air will be charged with a varying amount of salt-water spray. The local winds, however, constitute perhaps the distinguishing feature of coast climates. The perpetual movement of the air, the causes of which have already been explained, helps to account for the stimulating effects of many seaside health resorts. The experiments which Professor F. W. Beneke,¹ of Marburg, carried out on the little island of Norderney (on the North Sea coast), in the inland town of Marburg, and at various Swiss mountain localities, showed that heat was more rapidly lost from any warm body on the seashore than from a similar warm body at inland places, or even at high mountain localities. This fact is probably due to the perpetual movement of the air on the coast, and to its moisture, and possibly also to diminished loss of heat in the rarefied atmosphere of high altitudes. Increased loss of heat from the body has to be compensated by increased production of heat, and consequently seaside resorts like Norderney necessitate increased activity of the heat-producing organs of the body. The stimulating effect of sea-bathing, so often associated with a stay at seaside health resorts, must likewise be mentioned in this connection.

From a therapeutic point of view, seaside health resorts may be roughly divided into a warmer group, chiefly visited during winter, and a colder group, chiefly used for summer residence. The warmer group present great differences in humidity; amongst the more humid, Madeira, the Canary Islands, the west coast of

¹ 'Zur Lehre von der Differenz der Wirkung der Seeluft und der Gebirgsluft,' *Deut. Arch. für klin. Med.*, Leipzig, 1874, vol. xiii. p. 80.

Corsica (Ajaccio), and, in America, the West Indian Islands, may be classed, whilst the localities of the Western Riviera are types of the drier and less equable resorts. Amongst the colder resorts are those of the north-west coast of Europe and the localities on the Baltic Sea. The characters of the Baltic coast, however, incline somewhat towards those of the shores of large inland lakes.

The more bracing localities are suited for the stronger constitutions, but for patients with low reactive power the milder resorts have to be chosen. Sea air is useful in many classes of debilitated and anæmic patients, and in insomnia and mental exhaustion from overwork. It seems to have a specially good effect on the growing tissues of the young, and is of the greatest use in scrofulous and weakly children. Owing to the improvement in the general health, sea air, with or without sea-bathing, is often useful in a variety of conditions, such as leucorrhœa and amenorrhœa, and in some cases of sterility and impotence. The therapeutic uses of the different marine climates will, however, be further considered when we come to ocean voyages and the description of the various seaside health resorts. For girls and young women with typical chlorosis seaside places should generally not be recommended, especially places known often to exert a relaxing effect, like some of the resorts on the south-western coast of England. Sea air not rarely induces exacerbations of gouty affections, and it sometimes tends to bring on a condition of biliousness or constipation and drowsiness. It seems in these cases as if the appetite and the first stages of proteid catabolism were increased, whilst the functions of the organs concerned in the later stages of nitrogenous catabolism¹ and with the elimination of waste products remain defective. The same considerations may serve to explain why in persons (often members of gouty families) subject to attacks of migraine, asthma, and other 'paroxysmal neuroses' paroxysms seem sometimes to be induced by visits to the seaside, just as they would be by over-indulgence in eating and drinking. Some individuals may be said to have an idiosyncrasy towards sea air, so likely are they to suffer in one way or another whenever they visit the coast.² We need scarcely refer to that class of persons whose reactive powers (especially in regard to digestion and assimilation—i.e. anabolism) are insufficient for the increased demands made on them by the colder or more windy seaside resorts.

INLAND CLIMATES OF HIGH ALTITUDE

From a medical point of view, as we have already mentioned, it is impossible to classify climates into those of high altitude and those of low altitude by mere elevation above sea-level. The latitude of a place and the character of the surroundings (for instance, whether it is surrounded by much greater heights or not, whether the shelter from winds is good or bad, and whether the position is a sunny one or not) must likewise be taken into account.

¹ 'On the Biliousness sometimes Induced by Sea Air,' by F. Parkes Weber, *Treatment*, London, January 11, 1900.

² Cf. J. Hutchinson's case of 'Sea Air always Disagreeing,' *Archives of Surgery*, London, 1891, vol. ii. p. 91.

For present purposes we shall class places as of high altitude if their main climatic characteristics roughly correspond to those of elevations above 3,500 feet in the Swiss Alps.

The chief characteristics of high altitude climates may be shortly given as follows :

1. *Diminished atmospheric pressure and diminished density or greater rarity of the air.*—At a height of 16,000 feet the pressure of the atmosphere is barely half what it is at the sea-level, and consequently the air is so rarefied that a given volume contains only half the amount of oxygen that it does at sea-coast health resorts.

2. *Low degree of absolute and relative humidity of the air.*—Owing to the coldness at high altitudes, it stands to reason that the absolute humidity of the air must be less than at warmer places of low elevation. The question of relative humidity at high altitudes has been much discussed. It varies much at different times of the day, being low at midday, and high, as one would expect, at sunset. It must, however, be remembered that a high relative humidity of cold air corresponds to a very low relative humidity if the cold air be warmed up to the temperature of the lungs (about 99° F.) or to the temperature of the zone of clothes surrounding the body (about 89° F.). This is important in considering the drying effect of mountain air on the body.

3. *Absence or great infrequency of mists.*—Mists are mostly confined to the lowest parts of the mountain valleys, and seldom extend far up the slopes of the mountains. Clouds, however, are more frequent in mountainous districts of medium elevation than over lowlands. In the higher regions they are less frequent.

The relative frequency of clouds in certain districts at certain elevations is an important fact in regard to the climate of localities situated above or below such 'cloud levels.' The height of the cloud level depends on the distance of the place from the Equator and on the nature of the surroundings (such as the neighbourhood of higher mountain chains or low plains or large lakes), and varies somewhat according to the season of the year.

4. *Greater transparency and greater transcendancy of the air.*—These qualities result from the relative absence of clouds and mists and the low degree of absolute humidity. Owing to this the sun's rays are more powerful than in low altitudes, where the air is more humid. The greater amount of light (*greater insolation*) has doubtless an important influence on the physical and mental condition of invalids, but it largely also helps to render the air aseptic. (In regard to the so-called 'chemical rays' see later under No. 7.) The excess of ozone in mountain air may be mentioned in the same connection.

5. *Lower temperature in the shade.*—The coldness of the air

necessitates increased heat production to maintain the temperature of the body. It thus increases the activity of the heat-producing organs, a fact which is of great importance in the stronger constitutions.

6. *Greater difference between the temperature in the sun and that in the shade.*—With this is generally associated a greater diurnal range of temperature, which is due to the rapid and unopposed radiation from the ground through the dry, clear atmosphere into space.

7. *Greater purity of the atmosphere from organic and in-organic¹ dust, and the absence or rarity of micro-organisms.*—This purity of the air is doubtless due in part to the relative sparseness of the population at high altitudes and the absence of factories, and partly to the bactericidal action of light. Chemical rays, those at the violet end of the spectrum, are credited with a stronger bactericidal action than the other rays; and it has been found that these chemical rays are particularly abundant in high mountain regions, as shown by the rapid action of the light on photographic plates, and by the brilliant tints of gentians, campanulas, and many Alpine flowers.² In this connection it is likewise interesting to remember that Pasteur found the air over the glacier of the Mer-de-Glace very much freer from organisms than the air of the neighbouring village of Chamonix. The aseptic and antiseptic qualities of the climate of high altitudes are further evidenced by the results of the open treatment of wounds, according to O. Bernhard,³ of Samaden; and in this connection we may also refer to the work of Saake on radio-active emanations in the atmosphere of mountain localities (in the neighbourhood of Arosa).⁴

8. *Relative stillness of the atmosphere.*—The degree of movement in the air varies considerably according to the surroundings of the place and its position on a slope or in a valley or on a plateau. As we have already explained, the daily local winds are a characteristic feature of mountain climates. In winter, however, when there is a covering of snow, the ground cannot be heated during the daytime, and the local winds are therefore much diminished.

¹ The dustiness of the roads in the dry atmospheres of high altitudes may, however, sometimes be more than a trivial annoyance to summer visitors.

² See the tables showing increase in the ultra-violet rays with increasing altitude, according to J. Elster and H. Geitel, and the increase in the chemical intensity of sunlight, according to Bunsen and Roscoe, given in Hann's *General Climatology*, English translation by R. de Courcy Ward, 1903, pp. 234, 235.

³ 'Ueber offene Wundbehandlung durch Insolation und Eintrocknung,' *Münchener med. Wochenschrift*, 1904, No. 1, p. 18.

⁴ For evidence of special radio-activity in the atmosphere of high altitudes see Saake, 'Ein bislang unbekannter Faktor des Höhenklimas,' *Münchener med. Wochenschrift*, 1904, No. 1, p. 22; also *Physikalische Zeitschrift*, 1903, vol. iv. No. 23.

Effects of high altitudes.—‘Mountain sickness,’ the symptoms of which (including palpitation, faintness, breathlessness, weakness, and sometimes nausea and vomiting) vary in different cases, should be mentioned here, since, according to the theory first suggested by Jourdanet and confirmed by the experiments of Paul Bert, it is now generally supposed to result from the diminished amount of oxygen in the air at high altitudes, the consequent diminution of oxygen in the circulating blood causing a kind of asphyxia of the tissues. Doubtless, however, the fatigue of muscular exertion as well as idiosyncrasies and temporary conditions of the health (including digestive disturbances) often play a great part in the production of these symptoms.¹

Angelo Mosso's ingenious ‘acapnia’ theory of mountain sickness has not been confirmed by recent observations. Acapnia (literally, without smoke) is a word which he invented to signify deficiency of carbonic acid in the blood, and he thought that this deficiency deprived the respiratory centres of their normal amount of stimulation. His conclusions were based partly on observations at the Regina Margherita hut on the summit of Monte Rosa (15,000 feet above sea-level) and partly on experiments with the pneumatic chamber. He says that on Monte Rosa during the night a form of Cheyne-Stokes respiration was the rule, because, according to his theory, there was not enough carbonic acid in the blood to normally stimulate the respiratory centres, not because (as perhaps is the correct explanation for pathological cases) the respiratory centres had lost their normal irritability.² Zuntz, Loewy, Müller, and Caspari, in their recent work on the Climate of High Altitudes,³ quite oppose Mosso's explanation of mountain sickness. They say that the amount of carbonic acid in the blood does not simply depend on altitude, and that it is the tension, not the amount of carbonic acid, on which stimulation of the respiratory centres depends. By observations in the pneumatic chamber, just as on Monte Rosa, they found that mountain sickness was not in any way proportional to the carbonic acid tension in the blood.

Many individuals experience some degree of discomfort or distress on arriving at high mountain resorts, which may last three

¹ For an interesting discussion of the subject, including elaborate historical notes, see T. G. Longstaff, *Mountain Sickness*, London, 1906.

² See Angelo Mosso's *Life of Man on the High Alps*, English translation by R. J. Kiesow, London, 1898; and ‘L'Acapnie,’ *Comptes Rendus de la Société de Biologie*, Paris, 1897, p. 223. Haldane and Priestley (*Journal of Physiology*, 1905, vol. 32, p. 225) conclude: that the respiratory centre is so sensitive to any rise in the alveolar CO₂ pressure that a rise even of 0·2 per cent. of an atmosphere is sufficient to double the amount of alveolar ventilation during rest; that the respiratory centre begins to be excited by want of oxygen when the oxygen pressure in the inspired air falls below about 13 per cent. of an atmosphere; that apnoea depends upon a fall of the CO₂ pressure in the respiratory centre to below the threshold exciting value, the oxygen pressure being at the same time sufficiently high not to excite the centre. Dr. A. E. Boycott, who has experimentally tried the effects of low atmospheric pressures on himself, tells us that deficiency of oxygen *per se* is a very poor respiratory stimulus, and that in the pneumatic chamber, with a reduction of pressure corresponding to an altitude of 22,000 feet above sea-level, one has to deliberately breathe deeply in order to feel comfortable. He thinks there is no doubt that excess of carbonic acid, acting as a respiratory stimulant, could help one to stand very low atmospheric pressures better.

³ *Höhenklima und Bergwanderungen*, Berlin, 1906, p. 458.

of four days or a week or two before sufficient acclimatisation takes place. Thus there may be a certain difficulty in breathing, a vague sensation of cardiac uneasiness, transient palpitation, a tendency to headache, insomnia, mental excitability, temporary dizziness, or buzzing in the ears, and constipation of the bowels; dryness and irritability of the throat and thirst are often present. These effects may occur at any season of the year, and can be explained by the rarity and dryness of the air; but partly also by premature climbing exercise in persons who are out of training and quite unaccustomed to high altitudes.

The diminished density of the air at high elevations necessitates increased respiratory movements, which favour the development of the muscles of respiration and ultimately promote the expansion of the chest and lungs. An actual increase in the thoracic measurements has often been observed as a result of residence in high mountain resorts. Dr. C. T. Williams¹ says there is an enlargement of the thorax in various directions, with increased mobility of the thoracic walls, and an increase in circumference of one to three inches at different chest levels. He thinks that this enlargement of the thorax is most marked in those who take much exercise at high altitudes, and that it does not always persist after return to residence at sea-level. Sir H. Weber and Dr. M. G. Foster² say: 'A further result of this deeper manner of breathing is thoroughly to open up all the air vesicles, and thus to prevent any accumulation of secretions in them. After a more prolonged residence at high altitudes, a state is reached which has been termed "hypertrophy of the lung." The chest is enlarged to some extent and is hyper-resonant; the breath-sounds, instead of being weak, are puerile or exaggerated, but expiration is not prolonged. Whether this be merely a form of emphysema, or an actual increase in the respiratory area of the lungs, we cannot say; but after considerable experience, both of the natives of the high Alpine valleys and of consumptive patients, we can assert that this condition is very rarely associated with the ordinary symptoms of emphysema.'

By increasing the respiratory movements high altitudes likewise mechanically aid the circulation in the blood-vessels of the thoracic and abdominal cavities.

Increase of heat production and consequently increase of carbohydrate metabolism are rendered necessary by the cold dry air of high altitudes, and that carbohydrate metabolism is actually increased is evidenced by the increased amount of carbonic acid gas given off by the lungs. Observations on the nitrogenous metabolism of the body at moderately high altitudes show that

¹ *Aëro-therapeutics*, London, 1894, p. 110.

² Allbutt's *System of Medicine*, 1896, vol. i. p. 273.

with a suitable amount of muscular exercise the proteid gain exceeds the loss (*i.e.* assimilation and anabolism exceed catabolism).¹ Improvement of the appetite, digestion, general nutrition, and muscular strength of the body, occur in suitable cases. All this brings about increased resistance to disease, and in the early stages of a chronic infectious disease (pulmonary tuberculosis) enables the body better to cope with the invading parasites, opposes further progress of the disease, and favours cicatrisation and ultimate recovery.

In regard to the *effect of high altitudes on the blood*, there has been much discussion. Many observers have found that the number of red corpuscles rapidly increases and continues to increase for some time after reaching a high mountain resort.² Paul Bert (1882) found that the blood of the Peruvian mountain-sheep (Llama) was capable of absorbing much more oxygen than that of sheep living on the plains. In 1890 A. Müntz, comparing the blood of rabbits born at a considerable elevation in the Pyrenees with that of those born at low elevations, found that the blood of the former was richer in hæmoglobin and took up more oxygen. F. Viault noted that on ascending to localities of high elevation the number of red cells in the blood increased rapidly, relatively more so than the amount of hæmoglobin. He found that the blood of certain persons showed an increase of red corpuscles from five (normal) to eight millions in the cubic millimetre when they had remained for three weeks in the Peruvian Andes at an altitude of over 14,000 feet above sea-level. These observations were confirmed by various investigations in Europe reported by F. Miescher (of Basel), F. Egger (of Arosa), A. Mercier, A. Jaquet, F. Suter, J. Karcher, E. Veillon, F. Wolff, H. Koeppel,

¹ On the metabolic activity at high altitudes see the quite recent work, *Höhenklima und Bergwanderungen in ihrer Wirkung auf den Menschen*, by N. Zuntz, A. Loewy, F. Müller, and W. Caspari, Berlin, 1906, pp. 228-289. From the metabolic point of view the same altitude need not be equally favourable to different individuals. Age may have something to do with this, and probably more benefit is derived from high altitudes by young than by elderly persons.

² One of us gave a short summary of the matter in the *British Physician*, London, vol. i. p. 296, May 15, 1900. See also *Medical Climatology*, by S. E. Solly, Philadelphia, 1897, p. 109; and a review of the work up to 1901 by G. Schroeder, in *Zeitschrift für Tuberkulose*, Leipzig, 1901, vol. i. p. 505; and Oliver's *Blood and Blood-pressure*, London, 1901, p. 72. See also *The Blood Count at High Altitudes*, by W. A. Campbell and H. W. Hoagland, *American Journal of the Medical Sciences*, November 1901, pp. 654-664; and the writings on the changes in the blood at high altitudes by A. Jaquet (*Arch. für exper. Pathologie und Pharmakologie*, 1901, vol. xlv. p. 1), Armand-Delille and Mayer (*Journ. de Physiologie et de Pathologie Générale*, May 1904), Emil Abderhalden (*Zeitschrift für Biologie*, 1902, vol. xliii. pp. 125 and 443, and *Med. Klinik*, 1905, No. 9), and K. Bürker (*Münchener medicinische Wochenschrift*, February 7, 1905). For a general consideration of this whole subject see A. Jaquet's *Ueber die physiologische Wirkung des Höhenklimas*, Basel, 1904; and the large and comprehensive work, *Höhenklima und Bergwanderungen in ihrer Wirkung auf den Menschen*, by N. Zuntz, A. Loewy, F. Müller, and W. Caspari, Berlin, 1906, pp. 172-202.

and others. It appeared that the higher the elevation the greater was the increase of red cells in the circulating blood. On returning to low altitudes the number of red cells was found to sink to the ordinary.

F. Miescher¹ suggested that the want of oxygen in the blood, produced by the rarefied atmosphere, stimulated the functions of the red bone-marrow and so caused an increased formation of red cells, similar to that following an acute loss of blood by hæmorrhage. A. Gottstein, E. Meissen, and G. Schroeder thought that the chamber of the Thoma-Zeiss hæmocytometer was a source of error in counting the corpuscles, and Meissen and Schroeder therefore invented a special counting chamber termed Meissen's 'Schlitzkammer,' by using which they arrived at results very different from those obtained with the original Thoma-Zeiss instrument. But K. Turban² gave good reasons for believing that the ordinary Thoma-Zeiss apparatus could not be the source of the errors attributed to it by Meissen, if used according to the original directions, unless the atmospheric pressure were to be altered during the actual examination of the blood. Moreover, quite a number of observers (W. Roemisch, T. von Pacht, Campbell and Hoagland, A. Jaquet, Abderhalden, G. A. Buckmaster, &c.) using various instruments and methods have abundantly confirmed the view that both in man and animals there is a genuine increase in the number of red blood cells on ascending to high altitudes. Even if part of the immediate increase of corpuscles noted in the blood-counts be connected with greater concentration of the blood and altered distribution of blood corpuscles, increased formation of red corpuscles by the bone-marrow must be admitted, we think. The proportion of red cells in the blood seems generally to increase for two or three weeks (gradual acclimatisation) after arriving at a high mountain resort (like Arosa, in Switzerland); it then does not alter much, but on descent to low altitudes it soon returns to or near to the normal figure. Paul Regnard³ found that in animals an artificial atmosphere containing excess of oxygen reduced the number of red cells in the blood, whereas an artificially rarefied atmosphere led to increased formation of hæmoglobin. The value of these results was, however, diminished by the artificial conditions to which the animals were necessarily subjected, and by the possibility of excess of carbonic acid playing a part in the latter result. A. Jaquet and F. Suter⁴ showed that in rabbits kept at high altitudes (Davos) a very striking increase occurred not only in the proportion of red corpuscles and hæmoglobin in the blood, but likewise in the total amount of blood (and hæmoglobin)

¹ *Korrespondenzblatt für Schweizer Aerzte*, 1893, No. 24.

² *Münchener med. Wochenschrift*, 1899, No. 24. ³ *La Cure d'Altitude*, Paris, 1897

⁴ *Korrespondenzblatt für Schweizer Aerzte*, 1898, No. 4.

which could be extracted from the body.¹ Jaquet² afterwards obtained quite similar results (nearly parallel increase in the figures) by keeping rabbits in chambers in which the atmospheric pressure was artificially reduced to correspond to a fall of 100 mm. in the height of the barometric column. Various experiments quoted by Jaquet show that these changes in the quality and quantity of the blood (occurring as the result of living at high altitudes or experimentally produced by an artificially rarified atmosphere) cannot be the effects of low temperature or increased light.

The exact degree of reaction of the blood (as to number of red and white cells, specific gravity, &c.) in high altitude ascents and during visits to high mountain resorts doubtless varies in different individuals, and to some extent it may be according to age (probably best marked in youth) and temporary conditions of health. J. Gaule³ during a balloon ascent found that the increase in the number of red corpuscles was associated with the presence of erythroblasts (nucleated red cells) in the circulating blood, but this observation was not confirmed by Jolly,⁴ R. Bensaude,⁵ H. von Schroetter and N. Zuntz,⁶ or Abderhalden,⁷ all of whom examined blood taken during balloon ascents, nor indeed by the observations in the Alps recently published by Buckmaster.⁸

Typical examples of European high altitude resorts, including Davos, Arosa, St. Moritz, and Leysin, will be described in

¹ From their observations on rabbits at the summit of Mont-Blanc H. Guillemard and R. Moog (*Acad. des Sciences, Paris, Oct. 29, 1906*) also conclude that the total quantity of blood is increased at high altitudes. The effect of high altitudes on the total volume of the blood in human beings has not yet been investigated by J. S. Haldane and Lorrain Smith's 'carbon monoxide method' (*Journal of Physiology, 1900, vol. 25, p. 331*). Yet C. G. Douglas (*Journal of Physiology, 1906, vol. 33, p. 493*) has tested this method in animals and finds that the results obtained by it agree fairly closely with those obtained by the old Welcker's method in which the blood had to be extracted from the tissues after the death of the animal.

² *Arch. f. exper. Pathologie und Pharm., 1901, vol. 45, p. 1*; and *Ueber die Physiologische Wirkung des Höhenklimas, Basel, 1904, pp. 23-29*.

³ *Acad. des Sciences, Paris, November 25, 1901*; and *Pflüger's Archiv, Bonn, 1902, vol. 89, p. 119*.

⁴ *Société de Biologie, Paris, November 30, 1901*.

⁵ *Société de Biologie, Paris, December 7, 1901*.

⁶ *Pflüger's Archiv für die ges. Physiologie, Bonn, 1902, vol. 92, p. 479*.

⁷ 'Blutuntersuchungen im Luftballon,' *Pflüger's Archiv, Bonn, 1905, vol. 110, p. 95*.

⁸ Observations made jointly with Dent and Slater at various altitudes in the Alps—see *Morphology of Normal and Pathological Blood, London, 1906, pp. 29-41*. Buckmaster examined several hundred specimens of blood taken at high altitudes, but found neither nucleated red cells nor microcytes nor any features indicating excessive activity of the bone-marrow. He found nothing unusual in the number of blood-platelets. The development of polycythemia, which was accompanied by increase in specific gravity (of the total blood, not of the serum) and in hæmoglobin, commenced within 12-24 hours after reaching a height of 6,000 feet and tended to augment during some weeks. Return to a lower level was followed within 12-36 hours by a diminution in the hæmoglobin and corpuscles. Four days' residence at 14,000 feet gave no more marked polycythemia than at 6,000 feet. He is inclined to think that in European altitude of 6,000-8,000 feet gives the maximum polycythemia.

Chapter VII, and the characteristics of their climates will be compared with those of typical high altitude resorts of other parts of the world, namely in the Rocky Mountains of North America, in the Andes of South America, in the Himalayas of India, and in the interior table-land region of South Africa.

High altitude resorts can be made use of in many cases of the following conditions: Early pulmonary tuberculosis, when it occurs in persons who present no special contra-indication and have a constitution likely to be favourably influenced; convalescence from acute diseases; physical and mental exhaustion from overwork, worry, want of exercise, and town life; malarious affections and tropical cachexia; chronic glycosuria; in many cases of nervous asthma; in tendency to bronchial catarrh, with or without asthma, in children and young persons; in the lesser degrees of simple anæmia, and in some other morbid conditions. W. Erb, of Heidelberg, in 'Volkmann's Sammlung klinischer Vorträge,' 1900, No. 271, draws attention to the great value of a winter sojourn in high mountain resorts for many patients with neurasthenia, hysteria, certain psychical disorders, &c. The various therapeutic uses of high altitudes will be referred to later on, when the choice of climatic treatment in various diseases is being considered.

In regard to *contra-indications*, the resorts of this group, especially the higher ones, ought to be avoided in considerable dilatation of the heart with or without valvular disease; in atheromatous and fibrous changes of the heart and arteries; in emphysema of the lungs; in renal disease; and in nervous excitability and insanity. Old age by itself does not contra-indicate a stay at Alpine resorts during summer, especially in those previously accustomed to high altitudes. In regard to diseases of the heart and circulatory system we may add that it is when there is reason to suspect the commencement of progressive degenerative changes in the valves and walls of the heart and in the blood-vessels (*e.g.* coronary or cerebral arteries) that high altitudes should be regarded as dangerous, and not when there is only a chronic non-progressive slight defect in the mitral valve, a result left there by some long-passed attack of acute rheumatism.

In this respect, however, the experience of Dr. W. R. Huggard, who has long practised at Davos, is most important. He writes:¹ 'The truth probably is that rarefied air, in so far as it augments the strain thrown on the heart by exercise, does actually tend to develop cardiac disease. In my own observation it has appeared that persons who have come up to the mountains with mitral incompetence have generally complained of discomfort from the rarefied air. Persons affected with aortic disease, on the contrary, have but rarely suffered inconvenience.

¹ *Handbook of Climatic Treatment*, London, 1906, p. 121.

A special strain falls on the right ventricle when the blood is insufficiently aerated. . . . Cardiac discomfort is felt by some persons on arriving in Davos and for a few days afterwards. Ordinarily the sensation amounts only to a vague feeling of uneasiness in the cardiac region. Palpitation, with breathlessness, is a comparatively rare symptom; though waking up at night with a sense of suffocation is not very unusual, especially in fat and flatulent women, for some nights after arrival.' Huggard specially cautions against muscular exercise in any doubtful cases till the heart has to some extent adapted itself to the changed conditions (acclimatisation).

T. F. Zangger¹ directs special attention to the dangers of rapid ascents by mountain railways (which in various parts of the Alps transport persons to 7,000 to 10,000 feet above sea-level) in the cases of elderly persons with arteriosclerosis or contracted kidneys, who have perhaps never been cautioned against such ascents. He likewise states that bad results, in the shape of syncope, angina pectoris, cardiac asthma, or apoplexy, often occur only on the return to the lowlands after such excursions, and that patients with contracted kidneys are in the greatest danger.

The indications and contra-indications for high altitudes in cases of pulmonary tuberculosis will be considered later on, in Chapter XXXIII.

INLAND CLIMATES OF MODERATE AND LOW ALTITUDES

As resorts of **medium elevation** we class those whose climate roughly corresponds to that of localities in the Swiss Alps between 1,500 and 3,500 feet above sea-level. The places of this group present similar characteristics to those of high altitude, but in a lesser degree, because the air is generally somewhat warmer, and the humidity of the air somewhat greater in proportion to the increased barometric pressure; they are not so free from mist; the insolation is less intense; the snow does not cover the ground for so long a period. Their climates are therefore somewhat less stimulating and tonic than those of high altitudes, but they are better suited for patients with a tendency to dilatation of the heart and with slight degenerative changes in the vascular system, or with pulmonary emphysema or renal disease, and for the majority of persons in advanced age. They are also better borne by patients with irritable nervous constitutions who become sleepless or lose appetite at higher elevations.

It must not be forgotten that places of considerably lower altitude than the limit mentioned above may often have many of the bracing qualities of mountain resorts. This often, as S. Solis Cohen points out, depends on lower temperature with consequent lower absolute humidity of the air, and a certain degree of variability of the weather. Thus, in Northern Europe places at an elevation of 600 to 1,500 feet are often much more bracing than

¹ 'On the Danger of High Altitudes for Patients with Arteriosclerosis,' *Lancet*, June 17, 1899, p. 1628.

places at elevations of 2,000 to 3,000 feet in Italy or Southern Switzerland, especially in or near the lake districts. A good deal depends on whether the surroundings are much higher or not than the place itself. In islands like Great Britain localities at elevations of only 500 to 800 feet, especially when not surrounded by higher hills, usually exercise a more bracing effect than places of three or four times the elevation in Southern Europe. In this connection, however, the greater amount of wind and rain and moisture in the English climate, and the shorter duration of sunshine, must be taken into consideration.

In health resorts of '**low**' elevation, that is, below the elevation corresponding to 1,500 feet in the Swiss Alps, the variations in climate due to the latitude or isotherm in which the place lies, the mean temperature for the different seasons, the prevailing winds, the distance from the sea, and the purity of the air, are most important points to be considered. The climate of this group of places is likewise greatly influenced by the neighbourhood of mountains, inland lakes, and large forests, and by the situation, kind of soil, and quality of the drainage. Neighbouring factories and densely populated towns may have a prejudicial effect on the purity of the air. As summer resorts, situations in parks and near forests are generally preferable to those amidst meadows and cultivated fields. Places described as 'beautifully situated amongst vineyards' are often disagreeably hot for summer residence, and sometimes the flies and gnats constitute a great nuisance. Such localities may, however, be useful for the grape cure in autumn, especially if, as is often the case, the slopes above the vineyards are covered by fine woods, in which shady walks may be taken on level or slanting paths.

Inland climates of plains (so-called typical '**continental climates**') in the 'temperate zones' differ from climates of places under the influence of the ocean by being drier and less equable, having colder winters and hotter summers. Thus, Moscow, in the interior of the continent of Europe, has a difference of 53° F. between its mean January and mean July temperatures, whilst Glasgow, nearly in the same latitude, but close to the Atlantic Ocean, has a difference of less than 20° F. In the northern inland plains of European and Asiatic Russia and of the Dominion of Canada extremes are met with in the absolute annual range of temperature and in the difference between the mean temperatures of the coldest and hottest months of the year. Following are some examples of the differences (according to Hann, 1906) between the mean temperatures for January and July: Montreal, in Canada (latitude 45° 30'), 56·5° F.; Winnipeg, in Canada (latitude 49° 53'), 72·9° F.; Luktchun, in East

Turkestan (latitude $42^{\circ} 42'$), 76.9° F.; Tomsk, in West Siberia (latitude $56^{\circ} 30'$), 68.9° F.; Irkutsk, in East Siberia (latitude $52^{\circ} 16'$), 70.6° F.; Yakutsk, in East Siberia (latitude $62^{\circ} 1'$), 111.1° F.

Amongst the various climates of low elevation there are three groups which we will now separately consider, namely, the climates of the shores of large inland lakes, and the warm dry inland climates (desert climates) and cold dry inland climates.

Inland Lake Climates.—The inland climates of places situated on the *shores or islands of large lakes* have certain features in common, although of course in many respects they differ widely according to the nature of the surroundings, the line of latitude or isotherm in which they lie, &c. Owing to the large evaporating surface the air is more humid (though not necessarily excessively rainy) than at ordinary inland places, and the climate is more equable, but during winter there is often more mist than at other inland places (that is to say, if the degree of dryness of the soil is about the same at the various places compared). The daily range of temperature is less, and the winters (if the lakes are large and deep and remain unfrozen) are warmer, whilst the summers are cooler than at other inland places of low altitude on the same line of latitude. At Fort Brady, near the great American lakes Superior, Michigan, and Erie, the July temperature was found to be about 9° F. lower than at Fort Snelling, in Minnesota, situated westward nearly in the same latitude. The large surface of water gives rise to local currents of air, diurnal and nocturnal, like those of the sea-shore, and during hot summer weather the cool day breeze from the lake is very refreshing. If the configuration of the surrounding district is mountainous, as in the Swiss and Italian lakes, the local winds of mountain localities will often be present. Reflection of light from the surface of the lake generally increases the brightness of the aspect. The shelter from winds is often insufficient to allow of such places being chosen as satisfactory winter resorts for invalids, though the winter climate may be sufficiently warm, but in autumn and spring they are often useful, and often constitute what are termed 'intermediate stations,' where persons spend some weeks on their way from a warm winter resort to a northern (in the northern hemisphere) or alpine summer resort, or *vice versa*. Typical examples of this group will be described later on in Part I amongst the resorts of the Swiss and Italian lake districts.

Warm Dry Inland Climates (Desert Climates).—Over very large areas of dry ground the atmosphere must likewise necessarily be dry. This dryness renders the air more transparent and translucent, prevents the formation of fogs and clouds, and

diminishes rainfall. During the night heat is rapidly radiated through the dry atmosphere into space, and consequently the difference between the diurnal and nocturnal temperatures of the air is very great. The abundance of light, the dryness of the ground and air, and the absence of population render the air free from organic impurities and microbes.

According to H. Weber,¹ the characteristics of these desert climates are purity of the air, its richness in ozone, great warmth of the sun, abundance of light, dryness of the air, and infrequency of rainfall. The disadvantages of the desert are the violent winds, mostly accompanied by dust, which not only obscures the sun like a dense fog, but irritates the eyes and nasal mucous membrane, gets into the clothes, penetrates into closed rooms, and is deposited on all furniture and other articles lying there. These dust storms in Egypt are not limited to the periodical Khamseen winds (chiefly in March and April), but occasionally blow for one to three days at any time of the year. Another disadvantage is the absence of shelter in the actual desert, the traveller having to provide his own tents and servants. In selected cases, however, great benefit can be derived from a winter season, or occasionally from residence (in tents) for several entire years. The climate is suitable in many cases of chronic pulmonary tuberculosis, chronic bronchitis with much expectoration, albuminuria, rheumatoid arthritis, convalescence from pneumonia and bronchitis, insomnia from overwork, &c. H. McLure² attaches great value to a beneficial psychical effect from desert climates.

We shall return to the subject of the desert climate and its therapeutic uses when we describe the health resorts of Egypt.

Cold Dry Inland Climates.—As typical examples of cold dry inland climates of low altitude one must mention the winter climates of large plains in the colder latitudes of the so-called 'temperate zones,' where the ground remains frozen over during the winter months.

Such climates, which may almost be called 'cold desert climates,' in contrast with the warm desert climates just spoken of, have not been made much use of for therapeutic purposes, but H. Weber mentions good results obtained in Labrador in the cases of some missionaries and clerks with pulmonary tuberculosis of the first and beginning of the second stages. These were, how-

¹ Paper at the International Tuberculosis Congress in Berlin, *British Med. Journ.* June 3, 1899; see also F. M. Sandwith, *Egypt as a Winter Resort*, London, 1889; and H. E. Leigh Canney, *The Winter Meteorology of Egypt and its Influence on Disease*, London, 1897; also other writings on the subject referred to in our section on Egypt in Chapter IV.

² 'The Climatology of the Sahara,' *Journal of Balneology*, London, July 1905, p. 163.

ever, favourable cases, for the patients were all of originally strong constitution, without much family history of tuberculosis, free from any other disease, and with good circulation. Dr. Heron, at a meeting of the British Balneological Society in 1897, quoted the striking effects of bright cold weather in consumptive natives of the Hudson Bay Territory. Pulmonary tuberculosis is not rare amongst the poor Indians there. During summer time those affected remain in their hovels without energy to do anything, 'coughing their lives away.' With the cold of winter, however, a change for the better often occurs; the consumptive Indian then regains energy, takes to his snow-shoes and hunting, and becomes unrecognisable as the wretched being confined to his wigwam during summer. It must, moreover, not be overlooked that to the dry bright cold winter weather some of the good effects which high altitudes exert in suitable phthisical cases are doubtless due.

No persons are, however, suited for cold inland climates who lose energy and appetite and feel wretched in cold weather, nor very feeble or debilitated persons of any kind, whether the debility be the expression of an originally weak constitution or the result of infectious disease, insanitary mode of life, or old age; nor any of those who have a kind of idiosyncrasy in regard to cold, for instance, as it is almost needless to mention, the patients with paroxysmal hæmoglobinuria, a rare disease in which the attacks are sometimes induced by exposure to cold.

CHAPTER III

DESCRIPTION OF HEALTH RESORTS

WE shall arrange our descriptions of health resorts partly according to their geographical grouping, but partly according to the kind of climate they possess. Before, however, we describe the ordinary health resorts, we will shortly discuss 'the Ocean as a Health Resort,' or rather the value of various sea voyages for climatotherapeutic purposes.

OCEAN CLIMATES AND SEA VOYAGES

The pure ocean air can hardly be obtained except during an ocean voyage, and for the maximum effect one of the longer voyages of about six to sixteen weeks' duration must be chosen. Amongst the most suitable for therapeutic purposes are voyages to Australia and New Zealand, round the Cape of Good Hope (that round Cape Horn has the disadvantage of great cold and storms), and to the Cape of Good Hope itself. For rich persons, when a physician can be obtained to accompany them, voyages in private yachts can be often rendered beneficial.

Voyages on steamships between England and North America are too brief for most patients for whom the sea is indicated. For those, however, who require merely a holiday with change of surroundings, this trip affords great attractions, and may often be recommended.

The voyages from England to Madeira and the Canary Islands are likewise too short to obtain the full benefits of the ocean climate. Moreover, as the Bay of Biscay and the English Channel are noted for their storms, there is a likelihood of an unusual amount of rough weather during the voyage. In the case of 'good sailors' this very roughness of the sea has its special attraction. In cases of overwork, with resulting mental depression, tours to these beautiful islands and back may have a wonderfully good effect.

The voyages from England to the West Indies are too short for many patients, and unsuitable to others on account of the

warmth and humidity of these islands. Some constitutions, however, are benefited by a warm atmosphere, and in such cases these voyages can be made use of. The arrangements on the Royal Mail steamers are excellent. Unfortunately in many of the islands the presence of endemic diseases is a disadvantage. In the island of St. Thomas there are nearly always endemic diseases, but Barbadoes is generally free and may be selected for a stay. Jamaica and Demerara may be visited when they are free from yellow fever.

The voyages from England to Brazil and the Argentine Republic are somewhat longer and can likewise be undertaken in the Royal Mail steamers. The journey to Pernambuco takes 17 to 18 days, that to Bahia takes 18 to 20 days, that to Rio de Janeiro takes about 22 days, and that to Monte Video and Buenos Ayres takes 26 days. In the warm months of the year the localities on the coast between Pernambuco and Rio should not be visited on account of the heat and the frequent occurrence of endemic diseases; from Rio de Janeiro, however, more elevated and healthier regions can be reached. Much more to be recommended is an extension of the journey to Buenos Ayres and Monte Video on the River La Plata, by which means a longer sea voyage is obtained as well as a cooler and more bracing climate with satisfactory sanitary and social conditions. In many cases a prolonged stay can be made in these districts.

Amongst the shorter sea voyages that from England to the Cape of Good Hope probably offers the greatest advantages. The voyage in the steamships takes nearly three weeks, and the six weeks on the ocean required for the outward and homeward passage is sufficient for many cases. The arrangements on the ships of the recently combined Union-Castle Line are excellent, and the life on the ships is a source of great recreation to many. Frequently a long stay is made in South Africa before returning home. Though Cape Town itself is windy and dusty, there are localities at no great distance, such as Wynberg, Rondebosch, and Constantia, where a pleasant stay can be made. Caledon, with its hot springs, can be reached in two hours by rail from Cape Town. Natal, the Orange River Colony, and the Transvaal have many localities of high altitude which are suitable in the lighter cases of pulmonary tuberculosis, and which can easily be reached from Port Elizabeth or from Durban; but little progress has been made of late in regard to the provision of adequate sanatorium treatment.

The voyage from England to the East Indies, China, and Japan can seldom be recommended because the passage through the Mediterranean and the Red Sea exposes the patient to very

sudden changes in temperature. There are, however, certain patients who in the colder latitudes constantly suffer from catarrhs and rheumatic pains, which in warmer climates they get rid of. Such persons, instead of their usual winter visit to the South of France, Italy, and North Africa, may for a change visit the Eastern countries on one of the large ships of the Peninsular and Oriental Steam Navigation Company.

The voyage from England to Australia and New Zealand is the one which at present is generally recommended when the full effects of the ocean climate are desired. The voyage takes about six weeks in steamships and about ten to fourteen weeks in sailing ships. There are several routes from England to Australia. The 'East Indian' one is by way of Gibraltar, the Mediterranean, the Suez Canal, the Red Sea, and the Indian Ocean to Australia. The sudden changes of temperature to which the patient is exposed in passing through the Mediterranean and the Red Sea constitute a disadvantage from a therapeutic point of view, especially in phthisical cases. A second route is that across America by the railway between New York and San Francisco (the railway journey lasting several days and nights), and thence across the Pacific Ocean by Honolulu to New Zealand and Australia. A third route is across the Isthmus of Panama, and thence to San Francisco, and from there to New Zealand and Australia as in the second route. Both these routes have disadvantages, for there is either the long railway journey from New York to San Francisco to be accomplished, or the unwholesome climate of Panama to be encountered.

The fourth route, and the most suitable one for therapeutic purposes, is that by the North and South Atlantic Oceans around the Cape of Good Hope to Melbourne in Australia. By this route the ship, after leaving the English Channel, remains in the open ocean during the whole voyage. The choice lies between a sailing ship, a steamship, or a sailing ship with steam machinery, which can be used in case it is required. The patient should leave Europe at some time between the end of September and the commencement of November, and should be back again between the end of May and the end of June. The disadvantages of the voyage are the liability to sea-sickness and the uniformity in the food (lack of fresh vegetables and fruits). The heat may be severely felt during the long calms which occur in the 'doldrums' (belt of the equatorial calms),¹ during which sailing ships have to remain at rest unless provided with steam machinery which can be used for the occasion. In the interval

¹ The term 'doldrums' is sometimes used to signify the calms themselves, or the period of the calms.

between the outward and homeward voyages Hobart Town, in the island of Tasmania, is a suitable place to stop at. Melbourne itself is less suited, and Sydney, though most beautifully situated, is too hot during summer for most visitors; they can, however, reside in one of the more elevated localities which can be reached from Sydney. According to most medical authorities, it is best not to spend more than six to eight weeks between the arrival and the commencement of the homeward voyage; but the interval on land should not be too short, probably not less than three weeks.

Steamships seldom return to England from New Zealand and Australia by the Cape of Good Hope. The return journey can be made: (1) in a sailing ship by the Cape of Good Hope; (2) in a sailing ship around Cape Horn; (3) in a steamship and across the Isthmus of Panama; (4) in a steamship to San Francisco and thence by rail to New York; (5) in a steamship through the Red Sea and Suez Canal and the Mediterranean. The fifth route is the pleasantest for patients with sound lungs who are not severely ill, but it is somewhat dangerous for consumptives owing to the sudden change from the heat of the Red Sea to the uncertain climate of the Mediterranean, where cold violent winds are not rarely met with. The voyage around Cape Horn is unsuitable for most patients owing to the great cold during the colder seasons of the year. The most suitable route is that around the Cape of Good Hope, but it must be noted that the voyage in a sailing ship back to England by this route may last ten to even forty days longer than the outward voyage, because the winds are not so favourable. The return voyage is mostly made, on account of winds, in a somewhat warmer latitude, and not unfrequently a visit is made to the Cape of Good Hope and the island of St. Helena, where fresh food, especially fruit and vegetables, can be obtained. If for any reason, however, the voyage be made by the Suez Canal and the Red Sea, the time must be carefully chosen so as to avoid the hot months in the Red Sea, and the monsoon in the Indian Ocean.

In regard to the most suitable *time of year for voyages* from England we quote the following from Dr. R. W. Felkin:¹ 'To the Cape a patient may be sent all the year round, but it may be best to avoid being at the Cape in December and January, the hottest season there. For the Mediterranean the best season is from September to May. For Norway and Sweden, June to September. To India a patient should be sent so as to spend, say, December to the end of February if he wishes. A voyage may be taken to China or Japan, starting from

¹ 'Sea Voyages for Invalids,' *Journal of Balneology and Climatology*, London, January 1906, p. 9.

here in November and leaving either country not later than the end of January, unless a visit is paid to Hong Kong, which place may be visited between November and April. To the West Indies the traveller may go, leaving Southampton from October to January. To Rio, leaving this country in May or June, not later. To Australia, New Zealand, and Tasmania, patients may go or return *viâ* the Red Sea, between October and March. At all other seasons *viâ* the Cape.'

The *characteristics of the ocean climate* have already been alluded to. They are considerable humidity and equability of the atmosphere, with freedom from dust, microbes, and other impurities. On the ship's deck, of course, there is abundance of light, but unfortunately not so in most of the cabins. During a long ocean voyage the difference between the maximum and minimum temperatures in the shade on the same day is seldom more than 4° or 5° F. Even within the tropics the ocean air is seldom (except during total absence of wind) felt to be oppressively hot, as it might be at the same temperature on land, and the midday temperature is rarely above 85° F. The mean relative humidity is said to be about 73½ per cent. of saturation.

The *effects of an ocean voyage* should be sedative (but not relaxing or depressing) and at the same time tonic (being thus suited in certain lesser conditions of 'irritable weakness'). The life in the pure sea air increases the appetite, improves the general nutrition, and induces healthy sleep. Other conditions associated with an ocean voyage, and which relieve the nervous system, are the change of surroundings, the altered mode of life, and the freedom from troublesome letter writing and the ordinary cares, excitements, and worries of home life.

Unfortunately there are also disadvantages in sea voyages, which led Jules Rochard to say: 'that if the right sort of ship could be sent to the right place in the right kind of weather with the right sort of patients, a great deal of good might result.' Patients who try a long ocean voyage should be tolerably 'good sailors,' not too severely ill, and not too weak. There must be a fair amount of resistant power, and the organs of digestion and assimilation must be able to meet the requirements of the increased metabolism caused by the ocean air. Female patients feel the necessary discomforts of life on board ship generally more than men do, and they are seldom suitable for this method of treatment. The sleeping cabins and general accommodation should be as satisfactory as possible, and the dietetic arrangements good. The patient should take great care in selecting the ship and cabin, just as he would do were he choosing a house to live in. He should either himself inspect the ship and cabin offered him, or else he should get a person well acquainted with the

matter to do so for him. There should always be a medical man on the ship whose advice could be obtained when required, and in many cases the invalid should not be allowed to undertake the voyage unless he be accompanied by a special attendant (as in cases with mental complications) or by a medical man.

The *disadvantages of voyages* are the liability to rough weather and prolonged sea-sickness, monotonous dietary, and the narrow confined dark cabins. On long voyages the want of fresh vegetables and fruit is a drawback, and milk may be a source of difficulty in the case of patients for whom much fresh milk is required. Some of the drawbacks of a sea voyage could be avoided by the introduction of specially built ships, such as Sir H. Weber suggested in 1899,¹ so constructed as to constitute a kind of sanatorium. The cabins of such ships should be unusually large, and a separate one should be allowed to each patient. Everything which tends to decompose in very hot weather should be avoided. The general hygienic arrangements should be thoroughly considered, and a good doctor and specially trained attendants would be, of course, necessary. The amusement of the patients would have to be provided for by good music, &c. Healthy and interesting places should be visited, according to the season of the year, partly in order to let the patients land, and partly in order to obtain fresh food. The Mediterranean or West Indies might be visited during winter, and localities on the north-western coasts of Europe during summer; the route could be altered if advisable during the voyage, according to circumstances. The cost of such sanatorium voyages would, however, limit their use to the wealthy classes.

'Ship sanatoriums' or 'ocean sanatoriums' of this kind might be adapted to receive special classes of cases. Thus some might be reserved for convalescents and persons exhausted from overwork and mental worry, &c.; others might be adapted for dipsomaniacs and persons who have to be kept from obtaining alcohol, morphia, &c.; whilst yet other ships might be fitted out as special sanatoriums for pulmonary tuberculosis, the arrangements and

¹ *Zeitschrift für diätetische und physikalische Therapie*, Leipzig, 1899, vol. iii. It may be remarked that since this suggestion of Sir H. Weber 'medical' cruises on ships more or less adapted to serve as coasting or ocean sanatoriums have actually been arranged and attempted (1905) by the Hamburg-American Line. The same line has also introduced (relatively slow) voyages between Europe and America on large steamships specially built and fitted out, not for extraordinary speed, but for the comfort and pleasure of the passengers, the ship forming, in fact, a kind of floating first-class cosmopolitan hotel, the restaurant on which enables invalids to have diet specially selected for them instead of the ordinary *table d'hôte* meals. From the medical and general hygienic points of view it may also be noted that several ships of this line are furnished with gymnasium, medico-mechanical appliances for active and passive exercises, electric light baths and children's playroom.

regulations as to diet, medical supervision, and the avoidance of the spread of infection (disposal of sputa, &c.) being modelled on those in force at land sanatoriums for consumptives.

Voyages on private steam or sailing yachts fulfil some of the conditions which would be obtained by our ideal sanatorium ships, though they are mostly used for the shorter voyages only. The cabins are generally well arranged, and the patient remains amongst his family or friends. Though yachting is chiefly an occupation of healthy persons, it can be made use of as a method of treatment in many cases of mental depression and overwork requiring rest, pure air, and change of surroundings.

We shall now shortly consider some of the most important *indications for ocean voyages*. Great benefit is often derived by this method of treatment in cases of overwork, worry, and insomnia, with resulting depression and mental 'breakdown'; cases of irritable weakness of the nervous system and neurasthenia (when there is sufficient resistant power); delayed convalescence; various scrofulous conditions; and suspected tendency to pulmonary tuberculosis.

In the milder and quiescent forms of pulmonary tuberculosis sea voyages are often useful, provided that the patients be otherwise suited for life on ship. In the case of male patients with a liking for a life at sea, who are otherwise strong, or of an originally strong constitution, and who have become consumptive from 'chance' infection, or when weakened by overwork, mental worry, bad hygienic conditions, or acute diseases, long voyages are to be preferred to all other methods of treatment. In some more advanced stages of consumption ocean voyages may improve the general health in quiescent cases; even exhausted patients with large cavities in their lungs may sometimes pick up wonderfully. S. Solis Cohen tells us of cases of persistent high fever in consumption in which he has seen great amelioration and prolongation of life result from ocean voyages. He also urges ocean voyages in early cases of pulmonary tuberculosis, especially when announced by hæmorrhages.¹

In chronic catarrhal conditions of the larynx and air passages, in chronic rheumatic cases and rheumatoid arthritis, sea voyages in warm climates are not rarely useful—for instance, a winter voyage to the West Indies, to the Argentine States, or in the Mediterranean. In persons very susceptible to catarrhal attacks ('colds') and rheumatic pains from the least cold or draught, voyages often have a beneficial effect by increasing the power of resistance to the cause of these attacks. During sea

¹ Editor's addition in Cohen's *System of Physiologic Therapeutics*, vol. iii. 1901, p. 87.

voyages 'hay fever' is always absent, and voyages are therefore sometimes undertaken chiefly in order to escape this troublesome seasonal complaint.

Some chronic forms of diabetes mellitus, especially those in elderly persons when partly due to business worry and other mental disturbance or strain, are benefited by the removal of worry and the changed surroundings during a sea voyage.

By improvement of the general health, sea voyages may be of considerable utility in some cases of chronic catarrh of the urinary bladder, in the chronic results of gonorrhœa, and in minor forms of impotence; but in the latter cases the necessary temporary abstinence from attempts at sexual intercourse probably aids the beneficial action of the sea voyage. Long voyages on ships where alcoholic drinks cannot be obtained may sometimes be tried in the case of dipsomaniacs.

There are *certain precautions* of a general nature which patients should observe in the therapeutic use of sea voyages. They should be as long as possible in the pure air of the deck, and always be warmly clothed. The amount of sea-sickness may sometimes be diminished by not giving way too readily, and by coming from the close cabins on to the open deck. Opening the bowels by a mercurial aperient before going on board is often advisable. Amongst drugs to prevent sea-sickness a ten-grain dose of chloretone may sometimes do good service, followed later by a five-grain dose, if required. A series of slow deep inspirations accompanied by forcible contraction of the abdominal walls in the recumbent supine position may certainly in some persons temporarily drive off the commencing feeling of sea-sickness, but continual repetition of these respiratory gymnastics at short intervals cannot be long persisted in, and practically the method is only of use for quite short sea passages, such as between Dover and Calais. Great moderation in diet, together with the help of aperients, is in many persons required to prevent constipation and biliousness during a voyage. As much exercise should be taken as the conditions on board ship allow, and the state of the skin should be cared for by baths, friction, &c.

In gouty patients gouty attacks and exacerbations are on the whole more frequent at sea than inland; the appetite and metabolism are probably so increased that the kidneys, liver, skin, and intestines are overtaxed in getting rid of the waste products. This is at all events a possible explanation of the tendency to bilious disorders and neuralgic and gouty attacks produced by sea air in some persons. Hæmorrhoids not rarely manifest themselves on sea voyages, possibly on account of insufficient exercise, much eating, and scarcity of fresh vegetables. Voyages should not

be recommended to patients with cholelithiasis or with chronic catarrhal disorders of the stomach and intestines, especially when originally induced by habitual over-indulgence in food and drink ; and in chronic congestion of the abdominal organs from various causes, great caution should likewise be observed.

Sea voyages are contra-indicated: when they cause continued tendency to sea-sickness, and when the diet on board ship leads to persistent loss of appetite ; in cases of great general weakness ; in all severe diseases of the heart and blood-vessels ; in most advanced cases of tuberculosis ; in great tendency to hæmoptysis ; in epilepsy, in tendency to maniacal attacks, and in periodic insanity ; when there is an inclination to suicide ; when the glare on the sea cannot be borne, and in inflammatory conditions of the retina ; and in the rare cases where a sea trip causes sleeplessness.

CHAPTER IV

THE MEDITERRANEAN COAST AND NORTH AFRICA

THERE are considerable differences between the climates of different parts of the Mediterranean coast, and it is convenient to arrange them in different groups. All of them, however, are under the influence of the Mediterranean Sea, which differs from the Atlantic Ocean in being free from polar currents, these being excluded by the shallow Straits of Gibraltar. Outside the Straits the temperature is only about 36° F. at a depth of 1,500 to 2,000 fathoms, which corresponds to the deepest waters of the Mediterranean, where the temperature is as high as about 55° F. It is chiefly owing to the warmth of the Mediterranean water that Mediterranean health resorts are in general warmer than other places of the same latitude. The shelter from winds in different parts varies chiefly according to the proximity, size, and configuration of the mountains which adjoin a considerable portion of the coast. The rainfall, the amount of which depends largely on the same conditions, is peculiar in character, an almost rainless summer being followed by a rainy autumn and in some places by a good deal of rain in winter also. The humidity of the air varies much at different times of the day, particularly in warm bright weather and in the relatively drier climates of the Western Riviera, where the coolness and dampness which occur suddenly at sunset necessitate great care on the part of invalids. The far-famed Western Riviera naturally constitutes the first group of Mediterranean climates to be considered.

THE WESTERN RIVIERA

The 'Riviera' or 'Western Riviera' or 'Riviera di Ponente' is the narrow strip of coast-land (43° to 44½° latitude north) between Toulon and Genoa. It is mostly from one to four miles in width, open to the Mediterranean on the south and south-east, having a dry soil—chiefly of chalk—and more or less sheltered by mountain ridges on the north-east and north-west. The position of the various localities on the bays and headlands, and the nearness and configuration of the mountain slopes behind them, cause

considerable differences in the amount and kind of winds to which they are exposed. Excellent descriptions of the Riviera climates and health resorts have been given by James Henry Bennet, C. T. Williams, F. I. Sparks, M. G. Foster, and others.

The chief characteristics of the Riviera climate are its winter warmth, its relative dryness and small number of rainy days, and its brightness, which qualities render it cheering to the mind and stimulating to the body. The mean temperature for the three winter months (December to February) is from 47° F. to 49·8° F. For the six winter months (November to April) it averages about 51° F., the mean relative humidity being about 65 to 70 per cent. of saturation. The rainfall is 28 to 31 inches in the year, a great part falling about October and November. One hundred days or considerably more during the six winter months may be expected to be fine enough for most invalids to be several hours in the open air. At some parts of the coast direct reflection of light and heat from the rocks contributes to the warmth of the climate; from this circumstance Beaulieu has obtained the name of 'Petite Afrique.' The alternation of the land and sea breezes, as everywhere on the sea coast, causes sufficient circulation of the air.

Amongst the disadvantages of the Riviera should be mentioned the frequency of high winds and the troublesome dust, very little of which is, however, of organic nature. The winds are worst in the spring, when they have more or less the character of the well-known mistral, which we have alluded to in Chapter I. The great difference between the sun and shade temperatures, and the rapid fall of temperature (with increased relative humidity of the air) at sunset, are disadvantages in so far as they increase the danger of chill. Invalids have to return home at sunset, although some of them may go out again afterwards. The mosquitoes may likewise be a nuisance, but are in these localities not a serious disadvantage. Owing to carelessness in exposing themselves to chills, visitors are apt to catch ordinary 'colds' or suffer from bronchial catarrh, or, still more frequently, from an attack of diarrhoea or colitis or sometimes even colitis with dysenteric symptoms. Many of these supposed evils of the Riviera climate would be avoided were the patients to seek advice and directions from a local medical man on their arrival, instead of waiting, as they so often do, until a cold or exacerbation of their illness compels them to do so.

The Riviera season is from the end of October to the end of April, but most invalids from the north of Europe should not return to their own climates until the beginning of June, and should spend some weeks at a so-called intermediate station, such as Montreux, Glion, Lugano, Locarno, Villa d'Este, Cadenabbia,

Menaggio, Varese, and some other places on the Swiss and Italian lakes; some sheltered inland places further north, such as Baden-Baden, may likewise serve as intermediate stations for this purpose.

The patients suited for the Riviera are those who require more sunlight, warmth and dryness of air, and a more open-air life than they can get in colder winter climates. Amongst them are many persons of originally weak constitution, and those whose powers of resistance have been temporarily or permanently weakened by previous disease, injuries, or old age. In such cases the warmer winter climate, the longer time which can be spent in the open air, and the psychical effect of the sunshine and flowers, increase the mental and bodily activity and improve the general health. Ordinary chronic cases of pulmonary tuberculosis, catarrhal conditions of the respiratory organs, and the remains of pleurisy in feeble persons, and a great variety of chronic affections associated with deficient powers of reaction, are suited for the Riviera. It is, of course, not the nature of the disease which has exclusively to be considered, but the individual peculiarities of the patient. Owing to the action of the climate on the nervous system, excitable patients may suffer from sleeplessness, and neuralgic and mental disorders may be increased, disadvantages which are less felt at places on elevated ground removed from the shore, like Grasse, and in the less windy but less sunny and more rainy winter climate of Pau. Patients with dry catarrh of the respiratory organs and laryngeal irritability are better suited for moister climates, such as Ajaccio and Madeira. Amongst phthisical cases, patients for whom high altitude resorts are too cold, but who are well able to travel and who do not require a still warmer and drier winter climate, such as that of Egypt, are suited for the Riviera, when there is no special irritability or other reason to make a moister climate, such as Madeira, preferable. A drawback in regard to phthisical cases is the tendency for patients to live much as they like after the manner of the ordinary pleasure-seeking visitors who frequent the Riviera. By the institution of sanatoria where the patients would be under strict medical control, these drawbacks would be removed.

Hyères.—This place has a beautiful situation, about three miles from the sea, with southern vegetation and palms as fine as any on the Riviera. The mountain barrier on the north is, however, not complete, and gives easy access to the north-west wind or mistral. During the spring, therefore, when the mistral is common, it is less suitable for delicate invalids than more sheltered localities on the Riviera. In excitable nervous persons

the distance from the sea is an advantage. Sea air and air from the snow-covered mountains are both less felt than at Nice &c.; so that, as Sturge points out, Hyères occupies an independent therapeutic position amongst Riviera resorts. II. Weber has known many patients get rid of their nervous cough, asthma, or neuralgia at Hyères, when San Remo, Mentone, Bordighera, or Cannes did not agree.

Costebelle, about two miles south of Hyères, lies nearer to the sea, and, owing to the trees, is better sheltered from cold winds; though its position nearer to the sea tends to greater humidity, it lies on sandy soil which dries quickly, whilst Hyères is built on chalky soil which favours dust and mud. It consists only of hotels, and is beautifully situated near the top of the southern slope of a hill (eastern part of the Montagne des Oiseaux), covered with pine and 'maquis,' and tolerably protected from the north-west wind (mistral), but less so from the north-east wind; the latter, however, is not so frequent and on the whole less injurious at this part of the coast than the north-west wind. On the slope of the Montagne des Oiseaux, amidst a forest of pines, is the beautifully situated Sanatorium Mont-des-Oiseaux, suitable for patients requiring special forms of treatment with sanatorium supervision. The railway station San-Salvador-Mont-des-Oiseaux is close to the establishment. The San-Salvador Sanatorium for weakly children is situated on the shore about three miles from Costebelle, and besides this there is another children's sanatorium (the 'René Sabran Sanatorium') on the peninsula of GIENS, to the south of Hyères.

St. Raphael lies on the coast of the Bay of Fréjus, and is not well protected from cold winds. Its breezes must be welcome during the hotter months. VALESCURE lies a little further inland, on sloping ground, to the north-east of St. Raphael; it is fully exposed to the mistral, but the Esterel hills (picturesque reddish crags between Cannes and St. Raphael) afford a slight protection from the north-east winds; the pine trees are too scattered to afford shelter. Both these places are somewhat colder than the more eastern health resorts of the Riviera.

Cannes, brought into favour by the first Lord Brougham, is one of the most attractive spots in Europe, and has increased very much in size during the last twenty years. It is a large town, the largest of the mere health resorts on the Riviera, and presents somewhat different varieties of climate in its different quarters. Its sea frontage is very extensive, and looks towards the south. Cannes lies on two bays, an eastern and a western, separated by a promontory with a hill, on which the old town is built. The western bay is the finest in regard to scenery, but

the eastern is somewhat better sheltered from the mistral. The houses of the eastern part of Cannes extend further inland and stretch out for two or three miles among the pine trees on the slopes of the hill toward Antibes. The coast is studded with villas from La Bocca on the west to near Antibes on the east, that is, for five miles or more. Invalids who get on badly when living close to the sea may reside at one of the more inland hotels or villas, for instance, in the somewhat more elevated region of CANNET, two miles north of Cannes. Cannes is not sufficiently sheltered for very delicate patients who can stand no winds; they are better off at more sheltered localities, such as the eastern Bay of Mentone and Beaulieu. On the other hand, though high winds are not rare (particularly the mistral in February and March), the bracing character of the climate is an advantage in most cases.

Grasse, celebrated for its luxuriance of flowers and its manufacture of perfumes, is beautifully situated on the hills, at an altitude of about 1,000 feet, nine miles inland from Cannes, and is sheltered by considerable heights from the north, north-east, north-west, and also to some extent from the west. Its position in some respects reminds one of that of Les Avants above Montreux. The air is fresh and invigorating, the views and walks delightful, and the accommodation at the Grand Hotel, in the highest part of the town (1,100 feet), is very good. In regard to shelter, Grasse has the advantage of Cannes. Many cases of insomnia, neuralgia, asthma, lassitude, and some forms of dyspepsia, are relieved at Grasse though aggravated at the Riviera shore. It can be used as an intermediate station during spring by patients who have been spending the winter in the lower and hotter parts on the coast. It is connected by railway with both Cannes and Nice.

Antibes, on the coast between Cannes and Nice, to the east of the small headland of Antibes, is not sufficiently sheltered for delicate invalids, but is well suited for many persons who require open-air life and rest from mental work rather than any special shelter from winds. It commands a beautiful view of Nice and the Baie des Anges.

Nice has a bright and invigorating climate (mean temperature for the three winter months 48° F.), but its high winds¹ and the fact that it is the largest town on the coast and a great winter pleasure resort, attracting especially the gay class of visitors,

The lofty mountain ridges, which are especially near the coast at Nice, are covered with snow during the winter months, and probably, as Dr. Sturge points out, exercise a great influence on the winter climate of the town giving it some of its bracing quality.

renders it unsuitable for most genuine invalids. The Promenade des Anglais (i.e. the magnificent sea-front of the western or newer quarter), as well as the greater part of the town, is much exposed to winds and dust, but the suburbs of Carabacel and Cimiez are more sheltered and more removed from the sea, and somewhat less dusty. They are more suitable for nervous and delicate persons who suffer from digestive disturbances, insomnia, &c., when residing on the sea-shore. CIMIEZ, about three miles to the north, is situated on higher ground than Nice, and roughly bears a relation to Nice similar to that which Cannes does to Cannes. On the elevated ground of the MANTEGA (420 feet) there is a winter sanatorium for the treatment of tuberculous affections, &c. On the whole Nice offers great advantages to the large class of persons, including most of those with senile debility, who merely require a dry sunny climate with social attractions and facility for outdoor recreation. During the warmer weather there is good sea-bathing to be had at Nice. The temperature of the sea water in winter is generally between 53° and 61° F., and in summer between 64° and 75° F.; the lowest recorded temperature seems to be 46·4° F.¹ The water of the Mediterranean is slightly saltier than that of the Atlantic Ocean and North Sea, and about twice as salt as the average Baltic water, or still more so. On most parts of the Mediterranean coast, just as on the Baltic, there is no regular tide, and bathing arrangements are thus facilitated.

Villefranche (Villafranca) is situated in the Bay of Villefranche, and is more sheltered and warmer than Nice, from which the Villefranche railway station is 2½ miles distant.

Beaulieu, one mile further on the railway between Nice and Monte Carlo, is a small strip of land between the sea and high rocks, which shelter it from the N. and N.E. and partly from the N.W. It is famed for its olive, lemon, and orange trees, and the irradiation by the sun's rays partly reflected from the greyish rocks has procured for Beaulieu the name of 'Petite Afrique.'

Eze (Italian, Eza), the next station on the way to Monte Carlo, is situated on a very limited strip of ground, which is, if anything, still more sheltered than Beaulieu. Behind it rise the steep rocks (about 1,300 feet above sea-level) on which is the old village with the picturesque ruins of a castle founded by the Saracens in the ninth century.

Monte Carlo has a sheltered position and very beautiful scenery. It forms the eastern side of a bay, of which the western side is the lofty rocky headland crowned by the

¹ Figures from information kindly furnished by Dr. J. E. Brandt.

picturesque old castle and town of Monaco. LA CONDAMINE, facing south between the promontories of Monaco and Monte Carlo, lies on the shore and on the slopes of a semicircle of hills. In regard to climate, the Bay of Monaco rivals the eastern Bay of Mentone. Though the gaming tables, for which Monte Carlo is chiefly known, prevent its being widely used as a health resort for serious cases, the gay and varied life is an advantage for some persons. LA TURBIE (1,600 feet), and the magnificent scenery of the famous 'Corniche' road between Nice and Mentone, may be reached by a short excursion on the mountain railway from Monaco.

Menton or Mentone.—James Henry Bennet,¹ the founder of the English colony at Mentone, introduced the place to the English public by his writings on the Riviera, and it is now probably the best known real health resort of the Riviera. The mean temperature for the six colder months (November to April) is about 51.5° F. A rocky promontory on which the old town is built divides the Bay of Mentone into an eastern and a western portion. The western bay of Mentone is not so well sheltered as the eastern bay; but, owing to the hills being less steep and further from the sea, there are more walks, and invalids have the opportunity of living some distance from the sea-shore.

On the other hand, the eastern bay of Mentone shares with Beaulieu the advantage of being the most sheltered and warmest winter resort on the Riviera. The strip of land along the shore is, however, very narrow, on account of the proximity of the steep rocky slopes to the sea, and consequently there is no choice of walks and the dwellings are all close to the sea. In spite of its advantages for the particular invalids who require the greatest amount of warmth and shelter which the Riviera has to offer them, many find it relaxing, and the western bay is preferable for the majority of visitors. In the VALLEY OF GORBIO, 2½ miles from Mentone and the sea-shore, the Gorbio sanatorium for consumptive patients has been established in a sheltered position on the side of the valley at an elevation of 820 feet above sea-level. The cramped but picturesque and ancient town of Gorbio is perched on a hill much higher up the valley.

Cap Martin, in the commune of Roccabruno, between Mentone and Monte Carlo, 2 miles west of Mentone, should be mentioned, as it now possesses one of the best hotels on the Riviera. It lies at an elevation of about 150 feet above the Mediterranean, and is surrounded by a large pine forest with an undergrowth of rose-

¹ The first edition of his *Winter and Spring on the Shores of the Mediterranean* appeared in 1861.

mary, myrtle, lentiscus, cistus, &c. It has the great advantage of being nearly free from dust, and exercises a more soothing influence on the nervous system than does either Mentone or Monte Carlo. The pine forest with its undergrowth gives shelter from wind and sun, and fragrancy to the air. Good sites, if the land were to be had, could be selected in this neighbourhood for sanatoriums for serious pulmonary cases.

Ventimiglia, an interesting, steep, cramped old Ligurian town, with a more modern portion, the first railway station on the Italian side of the frontier, is not a health resort, and the valley of the Roya running north and south gives free access to the north wind.

Bordighera, the nearest health resort on the Italian side of the frontier, is somewhat more exposed than the eastern bay of Mentone, and on the whole has a more bracing climate than Mentone and San Remo. It is increasing in size. The newer hotels and villas lie away from the sea, in olive plantations, at the foot of hills, which afford protection from the north and east; a mountain spur likewise shelters them from the north-west winds, to which the sea-side portion of the place (containing the railway station) is exposed; they are therefore more sheltered and less dusty. The villas of the neighbouring BORGHETTO are protected from the wind. The mistral is said to reach Bordighera as a deflected wind from the west, modified by its passage over the sea. To the east of the health resort is the picturesque old town of Bordighera, on a steep hill rising from Capo San Ampeglio. The palms and olives of Bordighera are famous.

Ospedaletti, about half-way between Bordighera and San Remo, is spread out along the shore in a sheltered position, where the strip of coast-land is narrower than at Bordighera.

San Remo, 8 miles to the east of Bordighera, consists of the quaint old Ligurian town built on an eminence, and the visitors' quarters (the real health resort) on either side, situated in the midst of olive groves. The mean temperature for the three winter months (December to February) is given as 48.1° F. For the six winter months (November to April) it is about 50.5° F., rather less than that of Mentone; the mean relative humidity is about 68 per cent. of saturation. The bay has a southerly or rather somewhat south-easterly frontage. It is well sheltered from the north and north-west, so that the mistral is not so much felt, but the east wind is frequent. Many new hotels and villas have made their appearance both in the eastern and the western portions of the town, partly perhaps since the late Emperor Frederick made a trial of the climate. The eastern portion is that more frequented by Germans; the western by English.

San Remo is as suitable as any other resort on the Riviera for most pulmonary cases, but invalids requiring a special amount of shelter will generally do better at the eastern bay of Mentone or Beaulieu. Chronic rheumatic subjects, II. Weber thinks, more often derive benefit at San Remo than at the other Riviera localities.

Alassio lies in beautiful scenery, 28 miles from San Remo, on a portion of coast having a south-easterly frontage. The old town proper, with the hotels and most of the villas, lies close to the sea, but the surrounding semicircle of hills, especially the slopes facing the south and south-west, afford warmer and more suitable sites (already partly occupied by villas) for delicate invalids during winter, the town itself being exposed to the east and north-east. Alassio has not increased nearly as much in size as San Remo. Living is still cheaper at Alassio than in England. During a summer season of about eight weeks' duration the place is thronged by Italians for its sea air, its sandy shore, and good bathing.

The following meteorological data regarding Alassio and San Remo are from figures kindly furnished by Dr. Vittorio Balbi of the University Observatory at Turin.

	Mean barata Fahrer Fohrua	April	May	June	July	August	September	October	November	December	Mean annual tem- perature	Mean temperature for the three winter months (Dec. to Feb.)	Mean temperature for the six winter months (Nov. to April)	Mean annual relative humidity (per cent.)	Mean annual rainfall (inches)
San Remo) (1880-1890)	52.3	55.9	62.8	69.0	74.8	74.8	69.8	61.6	55.2	48.8	60.4	48.6	51.7	69	28.4
Alassio) (1885-1895)	46.4	48.3	52.4	58.0	64.0	71.3	75.7	76.2	72.6	63.1	55.2	49.0	60.8	47.9	

Pegli, 6 miles west of Genoa, is for convenience included in this group, but climatically as well as geographically has a kind of half-way position between the Western and Eastern Rivas. It has a more equable and sheltered climate than Genoa (see Chapter XI on 'Large Towns of Europe'), which is windy and rainy, but is distinguished by the greater relative humidity of its climate from the more western Riviera resorts. Pegli faces nearly due south, and is fairly sheltered from the north and north-west, and though its accommodation and medical arrangements are insufficient for serious cases, it will do for cases requiring little attention, and may be used as an intermediate station in spring by persons who, after wintering at one of the more western resorts, are on their way to the Swiss and Italian lakes.

Owing to the excellent electric tramway connection, Pegli has practically become a suburb of Genoa.

THE EASTERN RIVIERA

The 'Eastern Riviera' or the 'Riviera di Levante' comprises the coast of the Gulf of Genoa ($44\frac{1}{2}^{\circ}$ to $43\frac{1}{2}^{\circ}$ latitude north) from the termination of the Western Riviera at Genoa to Pisa. The winter climate of this district is on the whole moister and colder than that of the Western Riviera, but somewhat warmer and drier than that of Venice and the Austrian Adriatic localities (Abbazia, &c.). The coast-line of the Eastern Riviera has a southern or south-western aspect, and except at Nervi the wall of sheltering mountains is less perfect and further removed than that of the Western Riviera.

Nervi, $7\frac{1}{2}$ miles from Genoa, is the most important health resort of the Eastern Riviera. The proximity of the mountains to the shore is an advantage as regards shelter from winds, but helps to limit the walks for invalids. The mean daily range of temperature for December is said to be only about 4.7° F. The mean temperature for the three winter months seems not to be agreed on, but is probably slightly higher than that of the neighbouring city of Genoa (47.4° F.). Nervi is sheltered from the north-west, north, and north-east, but is somewhat exposed to the south-east wind (sirocco), which is chiefly felt in November. On the whole, in regard to shelter and natural advantages, this health resort rivals the majority of localities on the Western Riviera. One of the principal features of the place is the path constructed along the picturesque rocky coast, well sheltered and entirely free from dust; it is one of the finest seaside walks of its kind in Europe, and resembles the longer one at Abbazia. Most of the land belongs to private villas of rich Italian noble families; but the Eden Hotel, well situated on the slope, and some other hotels, afford good accommodation to the visitors, who are at present chiefly Germans. Some of the villas at Nervi lie high up on the hills, away from the shore. Nervi is better sheltered than Pegli, and its evergreen foliage is finer; owing to the excellent electric tramway connection, Nervi, like Pegli, can be regarded as a suburb of Genoa.

Further on the way to Pisa we pass **SANTA MARGHERITA**, ten miles from Nervi, and close to it, **RAPALLO**, considered by some the most beautiful locality of the Eastern Riviera. Both these places lie on the Bay of Rapallo, and are sheltered on the north. In a recess close to the southern extremity of the promontory which forms the eastern side of the Bay of Rapallo is

the small fishing village of PORTOFINO. The village itself lies close to the shore and offers very limited accommodation, but in a good situation high above the sea is the 'Hôtel Splendide,' with a beautiful prospect towards the bay and with pine woods in the neighbourhood, through which pleasant walks can be taken.

After Rapallo we come to CHIAVARI and SESTRI-LEVANTE, and further on to SPEZIA, half-way between Genoa and Pisa. Spezia is an important port and naval arsenal, besides a summer bathing resort and climatic winter station. It is situated on the flattish ground bordering the Gulf of Spezia, and faces south-east. A semicircle of mountains protects it from cold winds. Its public promenade, called the 'Marina,' and the good roads in the neighbourhood are advantages to invalids. Mean winter temperature (December to February) 46·6° F. VIAREGGIO, 13 miles from Pisa, is used for sea-bathing (chiefly by Italian families) during summer and as a climatic resort during winter. It lies on flat ground, with hills at a considerable distance to the east, but it has the advantage of being partially surrounded (from north-east to south-west) by a large pine forest, the 'Pineta,' which affords protection from winds during the cold months and from sun during the hot months. At Viareggio there is a sanatorium for scrofulous children, founded in 1841. For delicate invalids none of these places rivals Nervi.

Pisa now lies six miles from the sea, and hence is not, strictly speaking, a marine health resort. It is less recommended as a winter resort than it was. Its mean winter temperature is about 4° F. below that of the Western Riviera. It lies on flat ground, with the Pisan Hills at some distance to the north-east. To the east is the valley through which the Arno flows. The shelter is very defective, and cold winds are less rare than they were formerly reputed to be. The relative humidity is rather high (about 75 to 80 per cent. for the winter), and the annual rainfall has been given as about 51 inches. The sky is not seldom cloudy, but fogs are almost absent. There is less sunshine than on the Riviera coast. Facilities for outdoor exercise are not very good. On the whole Pisa may be said to have a fairly equable moist winter climate, with little wind, but relatively rather dull. At CISANELLO, near Pisa, a sanatorium for tuberculosis is to be erected. On the mouth of the Arno is a small sea-bathing resort, BOCCA D' ARNO. The great Tuscan port of LIVORNO (Leghorn), eleven miles from Pisa, has a fashionable sea-bathing season for Italian families. The real seaside resort is to the south of the port, stretching for about four miles along the shore, past ARDENZA, as far as ANTIGNANO. The country around Livorno is flat and low, but near Antignano the coast-land becomes hilly.

• Further southwards is the Tuscan island of ELBA, between the coast of Tuscany and Corsica. The scenery of Elba is mountainous and varied. Monte Capanne, the highest point of its mountains, reaches 3,340 feet above sea-level. PORTOFERRAJO (latitude $42^{\circ} 48'$ north), the chief town, beautifully situated on a bay at the north of the island, has a mean temperature of 49.5° F. for the three winter months, but is too windy a place for delicate invalids. In the warmer months there is sea-bathing. Portoferraio is reached in $5\frac{1}{2}$ hours by steamboat from Leghorn, and in two hours from Piombino.

SOUTHERN ITALY

Naples (latitude $40^{\circ} 46'$ north), owing to its beautiful position and its historical associations, has irresistible attractions for many persons, and may be chosen as a resort for distraction and recreation. The accommodation is good, and the town has become much healthier since the drainage has been improved and the overcrowding in the poorer quarters diminished, and especially since a pure water supply has been obtained (1885) from the Serina springs, which in Roman times were used for the famous Claudian Aqueduct. Dr. Vittorio Balbi has kindly obtained official meteorological data for us for the years 1876-1895. The mean monthly temperatures, beginning with January, are as follows: 47.3° F., 48.8° , 51.9° , 58.0° , 64.7° , 71.1° , 76.3° , 76.5° , 71.3° , 63.8° , 56.0° , 49.9° . Mean annual temperature, 61.4° . Mean temperature for the three winter months, 48.7° ; for the three summer months, 74.6° . Mean annual relative humidity, 65 per cent. Mean annual rainfall, 33.7 inches (mostly in the autumn and winter months). There is therefore a good deal of rain, and very poor protection from winds; the 'tramontana' (north or north-east wind) is especially felt. At Naples, as well as at other places on the Gulfs of Naples and Salerno, north winds generally bring clear bright weather, and south winds ('scirocco' &c.), rain and clouds. On the whole there is much dry sunny weather during winter. April and May (mean temperatures, 58° and 64.7° F.) are perhaps the most agreeable months. The houses on the south-eastern slope of the POSILIPO (officially POSILHIPO) ridge, extending from the Castel San Elmo along the coast to the south-west of the old town, especially those near the Corso Vittorio Emanuele and the Via Tasso, are preferable to those in the lower parts. Portions of the slope are well sheltered from the north and north-west.

Castellammare di Stabia and **Sorrento** are pleasant resorts for spring and autumn, but are exposed to cold winds from

the north, which blow especially in spring. Their position on the southern side of the Gulf of Naples shelters them from the south winds, owing to the high mountain ridge of the Peninsula of Sorrento extending from Monte San Angelo to Punta di Campanella. The mountains are further from the shore and rise less steeply on the northern side of the peninsula than on the southern side (Amalfi). Sorrento occupies the western end of a very fertile terrace (100 feet or so above sea-level) covered with luxuriant orange and olive groves &c. At the eastern, less sheltered end, about two miles from Sorrento, is the town of META, with more limited hotel accommodation. The hotel accommodation at both Castellammare and Sorrento is good, and their sunny climate might well attract persons on their way back in April to Northern Europe after having spent the winter months in Egypt or Algiers. The Hôtel Quisisana (about 290 feet above sea-level) and the neighbouring houses have an excellent situation on the high ground above Castellammare. Castellammare is likewise used by the Italians as a mineral water health resort and a sea-bathing place during summer. TORRE DEL GRECO, on the coast about half-way between Naples and Castellammare, has a quite exposed position at the south-western foot of Mount Vesuvius. It is a bracing resort during the colder months, and though very hot in summer, is then visited by Italians for its sea-bathing.

Amalfi, on the northern shore of the Bay of Salerno, is partly protected by the steeply rising mountains behind it from the cold north wind, and therefore affords better shelter in spring-time (when violent tramontana winds occur most frequently) than do the previously mentioned localities on the Bay of Naples. It is one of the sunniest places in Italy, its situation healthy, and its winter climate exhilarating. The hotel accommodation is good, but more limited than that at Naples and Sorrento. A disadvantage for some invalids is that there are scarcely any level walks excepting on the dusty high road. The twelve miles of coast-line between Amalfi and Salerno offer several picturesque sites, having similar climatic advantages, but as yet without good hotels. There is, however, some accommodation at POSITANO, about six miles to the west of Amalfi.

Salerno itself, though in beauty of position almost rivalling Naples, has lost its fame as a health resort owing to suspicion as to its hygienic arrangements and the danger of malaria. LA CAVA DEI TIRRENI (980 feet above sea-level), however, 6 miles inland from Salerno on the western side of the broad valley through which the railway to Naples passes, is a spring, summer, and autumn resort of a more healthy character, though said by Dr. Johnston-Lavis to be windy, cloudy, and dusty in the winter.

The neighbouring CORPO DI CAVA is situated higher up, close to the famous abbey of La Trinità della Cava, at the head of a pleasant wooded valley, with mountains on every side except the east. The islands of ISCHIA and CAPRI are too much exposed to be used as climatic resorts for real invalids during winter; both are, however, beautiful places for recreation. Ischia has several thermal springs, known from ancient times, as well as natural vapour baths and excellent facilities for sea-bathing in summer; the island has been noted for the medical use of hot sand-baths in chronic affections of the joints &c., but in recent times this method of treatment has been introduced at several localities on the continent of Europe.

SICILY

Sicily has advantages for the same class of cases as Southern Italy. The brightness of its climate and the historic and antiquarian interest of its towns should be useful in many cases requiring mere change and recreation, in persons who have developed glycosuria, mental depression &c. from business worry and brain fatigue, and in old persons whose brain and other organs are likely to derive healthy stimulation from the objects of interest. PALERMO, CATANIA, SYRACUSE, and ACIREALE are too hot in summer for natives of northern regions, and are in winter sometimes too much exposed to winds. Their cheerful character, however, acts favourably on the nervous system, and thus counterbalances the disadvantages of wind and dust, except in the case of the most delicate invalids.

Near PALERMO (latitude $38^{\circ} 6'$ north), the capital of Sicily, the VILLA IGELIA has a beautiful situation on the famous Conca d' Oro, about 130 feet above the shore, to the north of and 2 miles from the city, with which it is connected by electric tram. It faces south, and is sheltered at the back by Monte Pellegrino (about 2,000 feet), which protects it from the north wind. It was opened as a sanatorium for consumptives, but is now a hotel.

GIRGENTI (the ancient Agrigentum) will some day, when better accommodation has been provided, take a prominent place amongst this class of health resorts, but, with regard to beauty, all must yield to TAORMINA (the ancient Taormenium), which is situated on the eastern coast, on an abrupt hill, about 380 feet above Giardini, a station on the railway between Acireale and Messina. The hill on which it lies is in continuation with the north-eastern slopes of Mount Etna. The views of the sea and opposite shores of Italy are magnificent, and there is good hotel accommodation. The elevation of Taormina above sea-level is

an advantage for some persons; so are likewise the slight elevations of Acireale and parts of Palermo.

TERMINI-IMERESE, on the northern coast of Sicily, the 'Thermæ Himerenses' of the Romans, 23 miles from Palermo, possesses hot muriated waters, and the thermal establishment is kept open throughout the winter (see Chapter XVIII). On this account the place should become a useful health resort (though not so warm as Helouan, in Egypt) for arthritic patients needing spa-treatment during the colder months of the year.

The mean temperature for January¹ is 51.6° F. at Palermo, and 49.5° F. at Catania. Catania and the east coast of Sicily have a slightly colder and drier winter climate than Palermo. The hot sirocco (which is supposed to come from the dry African desert, having picked up its moisture in crossing the Mediterranean) is an occasional disagreeable and depressing factor of the Sicilian climate, but it is rare during winter.

In regard to temperature, the winter climate of Palermo and the coasts of Sicily takes an intermediate position between those of Egypt and the Riviera. It is colder, moister, and more equable than that of Cairo, and warmer, moister, and more equable than that of Nice. Owing, however, to its relatively high degree of humidity, it may better be compared with the climates of Corsica (Ajaccio) and of the Canary Islands and Madeira. The winter temperature of Palermo is slightly higher than that of Ajaccio, but lower than that of Orotava in Teneriffe and Funchal in Madeira. In relative humidity the climate of the Sicilian coast corresponds probably to that of Ajaccio, on the west coast of Corsica; the latter is, however, rather more sheltered. The climate of Madeira is, of course, much moister than either.

CORSICA

Ajaccio (latitude 41° 54' north) has an equable, moist, warm winter climate, considerably moister than that of the Riviera. The mean temperature for the three winter months has been variously estimated as about 49.7° to just above 52° F., which is slightly higher than that of Riviera localities, whilst the relative humidity is about 80 per cent. Though the humidity is high, the

¹ See 'Sicily as a Health Resort,' *Lancet*, June, July, August 1897. Hann (1897) gives the winter monthly means at Palermo as 54.1° F. (December), 51.8° (January), 52.7° (February). According to the Palermo meteorological data for the years 1876-1895, kindly obtained for us by Dr. Vittorio Balbi, following are the mean monthly temperatures, beginning with January: 50.8°, 51.6°, 54.5°, 59.2°, 65.7°, 71.6°, 76.8°, 78.3°, 74.7°, 67.1°, 59.6°, 53.4°. Mean annual temperature, 63.5°. Mean temperature for the three winter months, 51.9°. Mean annual relative humidity 65 per cent. Mean annual rainfall, 25.1 inches (chiefly in winter).

number of clear fine days is great, and there are only about fifteen thoroughly rainy days in the three winter months. The place lies on the northern shore of the Gulf of Ajaccio, which is open to the Mediterranean on the south-west. It is almost completely protected from north and east winds by the mountains behind it, the mild winds from the south-west being prevalent. Widenmann¹ points out that even the disagreeable dry cold mistral of the Western Riviera is scarcely found to be disagreeable when it reaches Ajaccio, because by its passage across the sea it becomes warmer and less dry. Besides the shelter from wind, the freedom from dust and mosquitoes, the situation on granite, and the beautiful walks and drives in the neighbourhood must especially be noticed. The air has a peculiar aromatic odour, due to the dense 'maquis,' or Corsican 'bush,' which covers all the surrounding hills, and is composed chiefly of arbutus, cistus, lentiscus, lavender, rosemary, myrtle, and heath; Napoleon when at St. Helena is reported to have said that with his eyes shut he would recognise Corsica by the aroma of the air. The accommodation at Ajaccio is excellent, and somewhat less expensive than it usually is on the Riviera. The principal hotels are situated at an elevation of several hundred feet above the sea.

Only such patients should be sent to Ajaccio as are likely to tolerate the moist sea climate. The place is well suited to invalids of a not too serious character who do not require very much supervision. Widenmann² says the place is suited for 'all persons who seek rest and recreation in a pleasant sedative climate amidst beautiful surroundings, especially for elder patients during convalescence, mentally overworked persons, and neurasthenics. For them the spring time at Ajaccio is best.' As yet it has not been visited much as a winter station by English-speaking people, but many of the lesser invalids who at present pass the winter at Cannes, Hyères &c. might visit Ajaccio for a change, provided they be content with somewhat less gaiety and social amusements, and indeed some patients who suffer from sleeplessness and neuralgic pains on the Riviera are better off in the more equable climate of Ajaccio. The best season for invalids is from the beginning of November to the middle of April. Ajaccio is likely to come more into use when better steamers are provided for the passage, from Marseilles, Livorno, or other ports.

Of the mineral springs in Corsica, those of OREZZA are best known. This place lies at an altitude of 1,960 feet, amongst the mountains of the north-eastern part of the island. The mineral waters are gaseous chalybeate, sometimes, however, containing a

¹ *Berliner klinische Wochenschrift*, 1903, No. 36, p. 837.

² *Loc. cit.*

Riva. It has an excellent sandy beach on the open Adriatic, with a south-easterly aspect, and would be a capital sea-bathing resort for the warmer months were it quite free from malaria. Though there is a certain amount of tide at this part of the Adriatic coast, the bathing establishment is a large wooden structure raised on posts similar to those in favour on the German Baltic coast.

THE AUSTRIAN COAST

The localities on the Austrian Adriatic coast have a higher relative humidity and are rather colder than the Riviera resorts. Their climate is more changeable, and most of them are subject to disagreeable winds, especially the cold 'bora,' or north-east wind, worst in winter and early spring.

TRIESTE (latitude $45^{\circ} 40'$ north), at the head of the Adriatic, the chief Austrian seaport, is too exposed to the bora wind during the winter season, and, though it can be used for sea-bathing during summer, is very hot and rather too large a town for a health resort. On the coast-land, about twenty miles to the north-west of Trieste, is the thermal muriated spring (100.2° F.) of MONFALCONE, alluded to in the 'Natural History' of Pliny. Near Aquileia, on the north of the entrance of the Gulf of Trieste, is GRADO, with a marine sanatorium for children; and on the southern shore of the Gulf, $1\frac{1}{2}$ miles to the south of Pirano, are the sea-baths of PORTO ROSE.

GORIZIA (German GÖRZ), though twelve miles from the north Adriatic coast, may be mentioned here, as the climate is influenced by sea breezes. It is a large town with an ancient castle, beautifully situated on the Isonzo at an altitude of 280 feet, on a plateau surrounded by hills, except at the south-west, where it is open towards the coast. It is not far from the Italian frontier, and the language of the inhabitants is Italian. In summer the heat is rather oppressive. The mean winter temperature is about 39° F., the same as that of Venice and Arco, and somewhat warmer than that of Meran and Montreux. The relative humidity is about 72 per cent. (Reimer). There is fair shelter from cold north winds, but this shelter would be improved if the surrounding hills were clothed with pines. Though the winter climate is not a warm one, it is sunnier than that of England. In Austria physicians recommend the place for its good air in convalescence from acute diseases, some pulmonary affections, &c. The chief season is from February to April or May.

Abbazia is the best known of the Austrian Adriatic health resorts. It is situated on the east coast of the peninsula of

Istria, and commands a magnificent view across the Gulf of Quarnero towards the port of Fiume and the islands of Veglia and Cherso. The strip of coast with an easterly or south-easterly frontage on which Abbazia and the neighbouring health resorts of VOLOSCA and LOVRANA lie, is called the 'Liburnian Riviera,' and is well sheltered towards the west by the heights of the Monte Maggiore (4,580 feet); against the bora or north-east wind, descending from the bleak plateau of the Karst,¹ the protection is much less perfect, though better than at Fiume and Trieste. Following are meteorological data, as given by Dr. Julius Glax, calculated from the records of fourteen years. Mean monthly temperatures, commencing with January: 40·6° F., 41·2°, 46·6°, 54°, 61·5°, 67·6°, 72·1°, 71·8°, 65·7°, 57°, 48·9°, 42·6°; mean annual temperature, 55·8°; absolute maximum, 96·8°; absolute minimum, 21·6°. The mean relative humidity is 78 per cent. for the year; 80 per cent. for winter. The annual rainfall is about 66 inches, and there are about five days in the year on which snow falls. The north-east wind (bora) is prevalent during winter, and the south-east (sirocco) during summer. The sirocco gives rise to no dust, but when it is violent it may, by dashing the waves against the rocky shore, give rise to so much spray that Glax compares the air along the shore on such occasions to that of an inhalation chamber full of a pulverised muriated mineral water. We need not describe Volosca and Lovrana separately: the former adjoins Abbazia on the north; the latter lies about four miles to the south, but may later on, by the building of fresh villas along the coast, become united with Abbazia, which, however, will remain the fashionable centre of the group. The vegetation of the Liburnian Riviera is partly deciduous, but consists partly also, and at some places almost entirely, of evergreen laurels; here and there are pines. A characteristic of the whole region—and a very agreeable one—is the practical absence of mosquitoes, just as at Ajaccio in Corsica. Abbazia can likewise boast of its pathway or promenade, constructed for a distance of three miles along the rocky shore, resembling the marine walk at Nervi, near Genoa. On the

¹ The 'Karst' or 'Carso' is a dreary undulating limestone plateau which extends from Gorizia to Fiume and Abbazia, and can be well studied around the railway station of St. Peter (1,900 feet above sea-level), between Gorizia and Fiume. The ground is strewn with fragments of limestone, and poorly covered by grass, underwood, and small recently planted pines. In former times pine forests doubtless afforded shelter from the 'bora,' which sweeps the Karst and has been known to blow over a loaded waggon. The present condition of the Karst may probably be accepted as an example of the bad results of stripping a country of its covering of trees. As analogous instances of this the present aspect of part of Greece, the arid state of Palestine, and difficulties in the water supply on certain islands, such as Curaçao, may be cited.

sloping ground near the health resort there are paths suitable for graduated uphill walking exercise ('Terrain-Cur'). Abbazia is much frequented during summer, when its establishments for sea-bathing are in great requisition. In winter (notably in February) it likewise attracts many visitors and invalids, and during fine clear weather is delightful. The mean temperature for the three winter months (about 41·5° F.) is rather higher than that of Venice, but in regard to warmth and dryness the 'Liburnian Riviera' falls considerably short of the true (Western) Riviera. A private sanatorium for children is under the able care of Dr. Szego. There is good hotel accommodation. We may mention that a popular amusement at Abbazia is feeding the sea-gulls, which are almost as tame as the pigeons of St. Mark at Venice.

Along the eastern Adriatic coast, further south, are CIRKVENICA and the islands of LUSSIN (with the towns of LUSSIN-PICCOLO and LUSSIN-GRANDE), LISSA, and LESINA. Cirkvenica is reached in an hour and a quarter by ship and three hours by carriage from Fiume. It is protected by the Velebit from the cold bora, and by the island of Veglia from the hot sirocco. The sands are excellent for bathing. The islands of Lissa and Lesina have, of course, a rather more marine and equable climate than the actual coast; their mean annual and mean winter temperatures are naturally somewhat lower than those of Corfu. RAGUSA is a beautiful and interesting town, but is unfortunately exposed to the sirocco. In regard to sunshine on the north-eastern Adriatic coast we will give the figures (kindly obtained for us by Mr. W. Marriott) for Pola, the great Austrian naval port, near the southern extremity of the peninsula of Istria, though Pola is not a health resort in any sense of the term. At Pola the average number of hours of sunshine (1885-1904) for the various months of the year, beginning with January, is as follows: 114, 135, 171, 210, 274, 296, 354, 327, 234, 163, 122, 106; the yearly average is 2,506 hours. Hann (1897) gives the following mean temperatures for the colder months (converted into degrees Fahrenheit):

	November	December	January	February	March
Lussin-Piccolo	52·9	46·6	45·0	45·5	49·3
Lissa	57·2	51·3	49·6	49·8	52·0
Lesina	55·6	49·3	47·3	48·4	51·4
Ragusa	56·8	50·8	48·6	49·8	52·9

THE IONIAN ISLANDS

The Ionian Islands have a higher mean annual temperature than the islands of the Austrian Adriatic. In summer they are rather too hot, and the weather is rather too changeable in winter for serious invalids. A place like Corfu, however, owing to its great

beauty of scenery and the exhilarating effect of the sky, may well be made use of in some cases of hypochondriasis, mental depression from overwork, and diminished resisting powers from old age, especially during spring and autumn. Corfu can also be employed as an intermediate station between Egypt and Central or Northern Europe.

Corfu (latitude $39^{\circ} 37'$ north) lies on the eastern coast of the island of which it is the capital, and is about 9 miles distant from the mountains of the opposite Albanian shore. According to the Austrian Adriatic Commission's Meteorological Station (1868-1879), the mean annual temperature is 63.9° F.; the coldest month is January, with a mean temperature of 50.5° F., and the hottest month August, with a mean temperature of 78.6° F. The mean temperature for the three winter months (as given by Hann) is about 51.6° F. A drawback of the Corfu climate is its raininess (annual rainfall is about 50 inches; number of rainy days is about 104—chiefly in autumn and winter), but the rainy weather has one advantage—it renders the place less dusty than many health resorts in the South of Europe. The roads dry quickly after rain. There is much sunny weather. The winds are sometimes strong.

Corfu became much better known as a health resort when the late Empress of Austria chose Gasturi, about four miles from the town, as a winter residence. A good many consumptive patients formerly visited the island, but it can scarcely be said that this class of cases is well suited there. There is a good deal of pulmonary tuberculosis amongst the natives, and the disease is doubtless favoured by the unhygienic dwellings of the poorer classes. At Corfu, as elsewhere, the establishment of a sanatorium for consumptive patients under medical supervision might be of great use.

Invalids of various classes who require little medical supervision might often be recommended to spend the winter in this beautiful place, where the accommodation is good, and the excellence of the roads, which were provided by the former English Administration, allows of many pleasant excursions being made. Most of the walks are hilly. Corfu is reached in about $12\frac{1}{2}$ hours from Brindisi, and in 2 days from Trieste. The best hotels are situated on a plateau about 90 feet above the harbour. A few villages situated on the hills might be used for summer residence, for instance, Agi Dekka, about 900 feet above sea-level, facing towards the north.

Among the other Ionian Islands, ZANTE may be mentioned, which has a similar climate but less satisfactory accommodation.

THE EASTERN PART OF THE MEDITERRANEAN AND THE BLACK SEA

Athens and **Constantinople** will be referred to later on, together with important cities of Europe which cannot strictly be regarded as health resorts (Chapter XI).

In the **Crimea** and at **Odessa**, and various places on the northern shore of the Black Sea, are brine lakes or 'limans,' the salt mud from which is used for mud baths. Such places can, therefore, independently of their climates, be regarded to some extent as health resorts. Sea-baths are employed at several of these localities.

ODESSA (latitude 46° 22' north), the great Russian seaport, situated on a bay of the north coast of the Black Sea, is built on a terrace 100 to 150 feet high. Mean temperature for the year, 48·5° F.; for January (the coldest month), 23·2°; for July (the hottest month), 73°. The annual rainfall is only about 14 inches. Odessa possesses sea-bathing places, as well as three salt lakes ('limans') with important establishments for mud baths.

Amongst the Crimean resorts frequented for their mud baths are SAKI, MOÏNAK, SEBASTOPOL, TCHOKRAK, and KERTCH. The so-called 'natural mud baths,'¹ as administered at the old-established resort of Saki, are peculiar. The mud, taken from the liman on the previous day, is laid on a slab so as to form what is termed a 'medallion,' and is heated in the sun. On this 'medallion' the patient lies down at full length, and the attendants rapidly cover him with the mud, leaving his face and neck free; in some cases, however, the thorax and abdomen are only covered by a folded sheet. A sunshade protects the patient's head, to which a fresh-water compress (frequently renewed) is kept applied. In about twenty minutes or less the mud is washed off with warm salt water, and the face and delicate parts of the skin are bathed with fresh water. The patient is then wrapped up and has to lie down for about two hours, during which abundant sweating takes place. In bad weather, when, owing to absence of sunshine, the 'natural mud baths' cannot be prepared, the so-called 'diluted mud baths' are given indoors. On the average about twelve mud baths constitute the course, which is often followed by brine baths and sea-bathing. More than one mud bath is never allowed on the same day, and in delicate subjects

¹ See *Les Stations de Boues Minérales de la Russie d'Europe*, by Professor A. Scherbakov, Moscow. 1897.

the doctors prescribe only one every other day. They are given under strict medical supervision. The mean temperature of the natural mud baths varies according to the sunshine, &c.; the outside temperature may rise to 122° F. or even more. The Crimean treatment has a reputation in Russia for muscular rheumatism, rheumatoid arthritis, and chronic articular affections, chronic affections of the pelvic organs in women, scrofulous conditions, and for syphilis (ordinary antisyphilitic methods are usually associated). The physicians regulate the diet and general regimen of the patients undergoing the treatment. At YALTA, on the southern coast of the Crimea, is a sanatorium ('Quisisana') for open-air treatment &c. pleasantly situated about 200 feet above the sea, and open throughout the year. As an autumn resort for milk, kephir, koumiss, and grape 'cures,' we may here mention GURZUF in Taurida.

Beyrout and its neighbourhood are sometimes visited by invalids in late spring. On the SLOPES OF THE LEBANON above Beyrout, H. Weber and M. G. Foster mention ALAI and BRUMENA as satisfactory. Such places can be regarded as useful resorts during late spring, summer, and autumn for residents in the large cities of Asia Minor, and for some of those who have spent the winter in Egypt and do not wish to return at once to Europe.

EGYPT

Alexandria, owing to the influence of the Mediterranean, has a moister and more equable climate, with a cooler summer and slightly warmer winter than Cairo. The mean annual temperature is 69° F.; the mean winter temperature, 60° F.; the mean daily range, only about 8° F.; the mean annual rainfall, 8·86 inches (of which 6·79 inches fall in November, December, and January). Though Alexandria itself is not a health resort in any sense of the term, RAMLEH, a modern resort on the coast, about four miles to the north-east of Alexandria, is a sea-bathing place during summer. Dr. Sandwith recommends Ramleh during April, when the weather is often pleasanter than in Cairo, in the case of invalids for whom Europe is not yet warm enough. Here, he says, they will find refreshing sea breezes, instead of the liability to the Khamseen wind in Cairo, a temperature which is not too high, and a degree of humidity which is not excessive. Canney thinks Ramleh suitable in the first half of May, and regards April as the best month for invalids at Mena House and Helouan.

The following table gives some newer meteorological averages (1891-1900) for Alexandria, Wadi Halfa, and Suakin, extracted

from the 'Meteorological Report' published by the Survey Department, Public Works Ministry, Cairo.

Months	Alexandria					Wadi Halfa			Suakin		
	Mean Temperature Fahrenheit	Absolute Maximum	Absolute Minimum	Relative Humidity per cent.	Rainfall Inches	Mean Temperature	Absolute Maximum	Absolute Minimum	Mean Temperature	Absolute Maximum	Absolute Minimum
January	57.4	77.0	41.7	62	2.12	59.4	93.0	34.0	73.6	86.0	50.0
February	58.6	85.5	43.2	65	0.88	62.6	99.0	35.1	73.4	84.9	50.0
March	61.2	98.6	41.9	61	0.66	71.4	109.9	41.0	75.7	89.1	50.0
April	65.1	102.0	51.8	62	0.10	80.4	116.1	48.0	79.2	93.9	46.0
May	70.3	102.0	55.9	65	0.05	87.8	116.1	56.5	86.0	107.1	63.0
June	75.2	102.9	56.8	69	—	90.7	118.9	62.1	91.4	111.9	66.9
July	79.0	98.6	68.9	71	—	90.5	114.1	57.0	94.3	115.0	69.1
August	79.9	95.0	68.5	67	—	90.0	111.0	57.9	95.4	114.1	72.0
September	78.1	104.0	65.7	66	0.03	86.7	116.1	55.0	91.6	111.9	66.0
October	74.7	100.0	59.0	66	0.35	82.6	116.1	55.9	86.9	100.9	64.0
November	68.0	90.0	51.4	63	1.50	70.9	102.0	41.0	81.1	95.0	59.0
December	61.0	84.0	44.2	65	3.16	63.0	93.0	37.0	75.2	91.0	55.9
Year	69.1	104.0	41.7	66	8.85	78.1	118.9	34.0	83.7	115.0	46.0

For convenience we will here proceed to the inland parts of Egypt, and then return to the consideration of the southern shores of the Mediterranean.

Cairo.—Latitude, 30° 2' north. Altitude, about 60 feet. Mean annual temperature, 70.4° F. Mean temperature for the four winter months (December to March), 59° F. Mean daily range of temperature, 25° F.; the least daily variations of temperature occur in winter, sometimes only 9° or 7° F. Mean relative humidity, 61.2 per cent. Dr. Canney,¹ from whom we have obtained most of the meteorological data of Egyptian resorts, says that the stability of the temperature is very marked in winter and autumn, but in the spring rapid changes take place at irregular intervals, the temperature rising suddenly only to fall again; this occurs especially during the period of the Khamseen winds in March and April. The Khamseen winds, to which we have already alluded in an earlier chapter, blow from the south and south-west for two to four days at a time. They bring excessive heat and marked dryness, with clouds of fine sand from the desert; the thermometer may rise to 100° F. or more, and the relative humidity may sink to 10 or even 3 per cent. A Khamseen may be abruptly followed by a north-west or west wind, with increase

¹ *The Winter Meteorology of Egypt and its Influence on Disease*, London, 1897. In regard to the climate of Egypt see also *Das Winterklima Egyptens*, by Dr. F. Engel (of Cairo), Berlin, 1903; and M. Kirchner, 'Ueber das Winterklima und einige hygienische Einrichtungen Aegyptens,' *Berliner klinische Wochenschrift*, 1906, Nos. 11 and 12.

of relative humidity and fall of temperature. During a Khamseen the daily variation in temperature may reach 42° or even 51° F. At Cairo the north wind is prevalent, and from May to October is almost the only one. There are only about seventeen days in the year on which rain falls, nearly all in winter and spring, and the total annual rainfall is only about $1\frac{1}{4}$ inches.

Owing to the sanitary arrangements of the crowded town itself, Cairo is hardly suitable for serious invalids, for whom, moreover, the social entertainments and sight-seeing constitute a grave source of danger. According to Dr. Sandwith,¹ the water supply is good during the winter, and is further improved by the prevalent use of Pasteur filters; typhoid fever is rare among the Cairo visitors, but is almost always present among the English soldiers, who drink from polluted sources outside barracks; good cow's milk can be obtained from several dairies. Invalids with pulmonary or renal affections are better off at Assouan, Luxor, or Helouan; but many of those who have no serious illness, though they require a winter holiday with mental recreation in a warm sunny climate, may spend the winter at Cairo. The season may be said to last from the middle of November to the middle of April. The hygienic arrangements of the hotels are, on the whole, satisfactory, but the expense of living is considerable. Those who wish to reside outside the town will prefer the Ghezirch Palace Hotel, 3 miles distant, or the Mena House Hotel, 8 miles away. Others may prefer to reside at Helouan, where the life is quieter and the expense less.

MENA HOUSE HOTEL, 8 miles from Cairo, with which it is connected by electric tram, lies near the Great Pyramid, at the edge of the western desert, about 20 or 30 feet above the cultivated land of the apex of the Nile delta. Mean temperature for the four winter months (December to March), $59\cdot5^{\circ}$ F.; mean relative humidity for the same period, 51·7 per cent. The climate is similar to that of Cairo, but the air is, of course, purer. The best season for Mena House is from the end of January to the end of March. One can reside there from the beginning of December, but the Nile Delta is not sufficiently dry to make December and the first half of January quite satisfactory.

Helouan, or Helwan, lies in an artificial oasis, 15 miles south of Cairo, in the eastern desert, about 2 miles to the east of the cultivated land of the Nile Valley, and 115 feet above it. To the north-east the Mokattam Hills gradually rise to a height of 1,500 feet. The little town is completely surrounded on all sides by the desert, to which fact it doubtless owes much of its value

¹ *Brit. Med. Journ.* Oct. 3, 1896.

from the climatic point of view. Dr. Page May¹ gives valuable meteorological observations for the five months (November to March) of the four winter seasons 1896-1900. The average sunshine for the five months, as registered by the Jordan sunshine recorder, was 1,250 hours—that is to say, a daily average of eight hours. The average temperature was 60° F. (mean maximum 70·2°, mean minimum 49·8°), and the average daily range was 20·3° F. (Dr. Page May points out that Luxor and Assouan have a daily range of about 7° F. more than Helouan and Cairo.) The absolute lowest temperature, 30·2° F., occurred in March 1899. The mean relative humidity for the five months in question at 9 A.M. was 59·8 per cent. of saturation; at 9 P.M. 57·6 per cent. The anemometer record showed that Helouan is not a windy place; February was the most windy of the five months, and November the least. In regard to dust, Dr. Page May points out that Helouan has the advantage of lying to the east of the Nile, the dust storms almost invariably originating to the west of the Nile. The average rainfall for the five months was less than $\frac{3}{4}$ inch.

The warm springs of Helouan, which give it the title of Helouan-les-Bains, were made use of at least as early as 1600 years before the Christian era, but date their modern reputation only from 1868, when Ismail Pasha appointed a scientific commission to investigate them. According to Attfield's analysis (1896), the muriated sulphur waters (90° F.) contain 5 grammes of common salt per litre, and 0·09 of sulphuretted hydrogen, equal to rather more than 60 volumes of the gas in a thousand volumes of the water. There are likewise simple muriated and muriated chalybeate waters. The new complete thermal establishment, opened in 1899, was planned with great care by Dr. Page May. Helouan, which can be reached in about half an hour by train from Cairo, has a nearly complete desert climate (see the general characters of the desert climate described in Chapter II), and can be employed from the middle of November to the middle of April. The baths must greatly assist the action of the climate in chronic joint affections, rheumatoid arthritis, &c. The Grand Hotel and the recently established Tewfik Palace Hotel (140 feet above the Nile Valley) are both excellent. There is likewise a sanatorium ('Al Hayat'), situated on the Mokattam Hills, 290 feet above the Nile level, founded in 1903 for chronic cases needing supervision by a resident medical man.²

Luxor.—The localities of Upper Egypt have a warmer and drier winter climate, with a greater daily range of temperature,

¹ W. Page May, *Helwân and the Egyptian Desert*, London, 1901.

² Cf. F. Plehn's article in *Zeitschrift für Tuberkulose*, Leipzig, 1904, vol. v.

than the neighbourhood of Cairo ; owing to the higher temperature the season for invalids is somewhat shorter. Canney says the daily range of temperature is 5° or 6° F. greater in Upper than in Lower Egypt, and increases from December to April. Luxor lies in latitude $25^{\circ} 39'$ north, 450 miles south of Cairo, on the right bank of the Nile, 241 feet above sea-level. The mean temperature for the four winter months (December to March) is 63.8° F., and the mean relative humidity for the same period is 36.3 per cent. Rain is very rare—much rarer even than at Cairo. There is less wind at Luxor than at Cairo and Assouan, and apparently in December there may sometimes not be enough. Luxor is in the centre of a district of great archæological interest (the ancient Thebes), and is thronged with excursionists. The place itself consists of the hotels and the unhygienic dwellings of the native population. Owing to the cultivated land about Luxor, the climate has not quite so marked a desert character as at Helouan and Assouan, and is less suited for some cases of rheumatism. The season for invalids is from the commencement of December to the middle of March.

Assouan, or Asswan (Syene, to which Juvenal was banished in his old age), is, for the present at least, the southernmost health resort of Egypt, lying at latitude $24^{\circ} 5'$ north, on the north side of the first cataract, 583 miles by the Nile from Cairo. It is still warmer and drier than Luxor, but more windy. Mean temperature for the four winter months (December to March), 68.3° F. ; mean relative humidity for the same period, 30.5 per cent. The best time for invalids is about the same as at Luxor. Dr. Page May,¹ in comparing Assouan with Helouan, points out that Assouan is warmer (by 8.4° F. daily average), more variable in temperature (average daily range being 6.2° F. more), drier, windier, dustier, and sunnier.

The **Nile Voyage** can either be made on private ships ('dahabeyahs') or on the passenger steamboats. On these steamboats great care is required to avoid contracting colds. The winds are often strong, and draughts can hardly be avoided ; the temperature (sun and shade) of different parts of the ship may be very different. On the other hand, the passengers have the advantage of being accompanied by a doctor. Invalids on dahabeyahs can proceed more leisurely and can better avoid high winds, but the cost is greater and there is no doctor at hand unless one be especially engaged for the voyage.

The favourable features which these winter climates of Egypt have in common are : (1) Plenty of sunshine and a sky generally clear ; (2) a high average temperature, with considerable daily

¹ *Loc. cit.* p. 53.

range; (3) low relative humidity and very little rain; (4) purity of air, at least in the thinly peopled districts. The disadvantages for climatotherapeutic purposes are: (1) the winds laden with dust, already alluded to; (2) the short duration of the invalid season; (3) the long journey out, and the sudden return to very different climates in spring; (4) the difficulty of keeping serious cases under sufficient medical supervision. Moreover, Sir H. Weber remarks that during his visits he has not found the weather in Egypt as constant as it has been reputed to be. An important feature of the desert climate is that in spite of the considerable daily range of temperature there is no very sudden cooling of the air to give rise to chilliness at sunset.

The cases of pulmonary tuberculosis sent to Egypt should not be acute or very far advanced; the patients should be sufficiently strong to stand the journey, and should not be affected by laryngeal or intestinal tuberculosis, or by chronic diarrhoea. With these exceptions the following cases are suitable: (1) cases complicated by albuminuria; (2) cases complicated by emphysema, bronchitis, or bronchiectasis, with copious expectoration, or with a tendency to repeated attacks of bronchitis. Many of the cases treated at the Riviera resorts could be as well sent to Egypt. Both on the Riviera and in Egypt the patient has to be very careful not to expose himself to chills; and at both groups of health resorts there is a tendency for the patients not to be sufficiently under medical control. The practice of sending patients to health resorts without urging the necessity of seeking constant local medical guidance is strongly to be deprecated. Still more so is the practice of consumptive patients resorting to the 'Egyptian climate' (as if any place in Egypt would do equally well) without medical advice. In this connection the increase of mortality from tuberculosis in Egypt, as shown by Legrand-Herrmann at the Paris International Tuberculosis Congress of 1905, is specially worthy of note, the spread of infection from consumptive visitors to natives having doubtless been favoured by the insanitary native dwellings, the abuse of alcohol, &c. At some time in the future, perhaps, sanatoria will be established under medical supervision in the actual desert near the resorts of Upper Egypt. Dr. Canney's meteorological observations would tend to show that the desert climate near Luxor has a smaller daily range of temperature and a lower relative humidity than the climate of Luxor itself.

Amongst other cases likely to derive benefit are the following:

(1) Various forms of albuminuria and chronic renal disease, and convalescence from acute nephritis.

• (2) Chronic bronchitis and emphysema, bronchiectasis, and chronic catarrhal conditions of the respiratory passages, and tendency to repeated attacks of catarrh.

These two classes of cases must be regarded as unsuitable for the ordinary passenger steamboats of the Nile as long as no special arrangements are made for invalids.

(3) Convalescence from acute pulmonary and other diseases in individuals who cannot stand cold and high elevations.

(4) Many cases of rheumatoid arthritis, chronic gout, sciatica, &c. In these cases the climate may be greatly assisted by the thermal baths and douches of Helouan.

(5) The large class of persons for whom all that is needed is a warm sunny winter climate with mental recreation. This class includes a number of chronic invalids of weak constitution, who suffer in various ways if they attempt to pass the winter in cold climates; old persons and prematurely old persons; and cases of mental depression, insomnia, mild glycosuria, and dyspepsia, due to overwork, mental worry, and town life. In many of these cases the Nile voyage may be recommended, with or without medical supervision, according to special circumstances.

In all these cases the warm climate has at least the advantage of enabling the patient to spend much more time in the open air than he could in a colder country. A warm winter climate, in fact, is sometimes recommended in various morbid conditions merely in order that a modified 'open-air treatment' may be carried out. Persons with dysentery or convalescent from dysentery, or with chronic diarrhoea or great tendency to diarrhoea, should be advised not to visit Egypt.

On leaving Egypt, one of the Mediterranean localities, such as Amalfi, Sorrento, Naples, the Riviera, or Corfu, may be visited in April and May. Such an intermediate station must be carefully selected according to the special circumstances of the case. At Ramleh, near Alexandria, patients can remain till the end of May, but here again for consumptive patients there is the danger of insufficient medical control.

ALGERIA

Algiers, on the Mediterranean coast, about half-way between Tunis and Tangier, is situated in 36° 45' latitude north, i.e. just slightly further north than Malaga in Spain, and slightly further south than the southern point of Sicily. The mean winter (December to February) temperature is about 54·4° F. The mean temperature for the 'six winter months' (November to April inclusive) which constitute the invalid season is said to

be about 60° F., slightly lower than that of Funchal in Madeira, and probably 1° or 2° F. higher than that of Catania and Palermo in Sicily, and about 10° F. higher than that of the Western Riviera. The humidity of the air is greater than that of the Western Riviera, and less than that of Tangier and Madeira. The daily range of temperature is greater than that of Madeira. The mean annual rainfall is 32 inches—three-quarters of it in the six winter months. The number of rainy days during winter is considerable, about 45 to 65, but appears to vary much in different years. The rain, however, usually falls heavily and ceases suddenly, and, owing to the porosity of the soil, the ground does not long remain wet. The sirocco, a dry, hot, dusty south-west wind from the desert, against which Algiers is not entirely protected by the mountains, is seldom felt during the winter months; the prevailing wind is the north-west from the Mediterranean.

The old Moorish town of Algiers is not sufficiently advanced in its sanitary and drainage arrangements to be recommended to invalids, but MUSTAPHA SUPÉRIEUR is not only more European in its sanitation, but has a better position than the old town. This favourite suburb lies on the slopes of the hills above the lower town; it faces the east, and is sheltered from the north-west by rising ground. Its hotels and villas afford excellent accommodation. The quarter of EL BIAR is higher and more bracing, but affords no hotel accommodation at present. The hills about Algiers are not dry and arid, as has been supposed by some, but are covered with flowers, heather, evergreen shrubs, eucalyptus trees, pines, &c. There are beautiful walks and drives in various directions. The weather is, however, very uncertain, so that visitors during different winters may get totally different ideas of the climate.

Many cases of emphysema, irritable cough, and the lingering effects of pleurisy and pneumonia derive benefit from a winter season at Algiers. Early chronic cases of phthisis may sometimes be sent thither when for any reason high altitudes are not well borne, and both Egypt and the Riviera are too dry. Aged persons and delicate people for whom an interesting, warm, sunny winter resort is all that is needed, might spend the whole or part of the season at Mustapha just as well as in Egypt or on the Riviera. About 3 miles from Algiers is a sanatorium (650 feet) for consumptive and other patients.

Blida, a station on the railway between Algiers and Oran, about 31 miles to the south-west of Algiers, is beautifully situated at the foot of the Lesser Atlas range. It is more bracing and less sheltered than Algiers, and is a pleasant place during March and April for a change after leaving that town.

There are nice walks in the neighbourhood and fair hotel accommodation.

Hamman R'Irha, about 60 miles south-west of Algiers and about 15 miles from the coast, is situated on a terrace of the Lesser Atlas Mountains at an elevation of about 1,800 feet above sea-level, an hour's drive from the railway station of Bou-Medfa, on the railway between Algiers and Oran. The mean temperature for the six winter months (November to April) is said to be about 55° F.—that is, 5° lower than that of Algiers. The difference between the winter and summer means is relatively small. There is very little shelter from any side, and the cold north-west wind is sometimes severely felt. The number of rainy days is considerable. The place stands on the ruins of the Roman 'Aque Calidæ.'

The place is chiefly known for its hot baths (temperature of the hottest spring is about 153° F.), which are open all the year, but most frequented in spring and autumn. They were employed by the Romans, and are now used for chronic gouty and neuralgic cases &c. like the baths of Wiesbaden, Aix-les-Bains, and Bath, in Europe. The French have a thermal military hospital there.

Winter visitors to Algiers might spend part of the spring at Hamman R'Irha when they find Algiers unpleasantly hot. For the hardier kinds of invalids suffering from the results of overwork, mental worry, or from imperfect convalescence after acute diseases, the whole winter season would probably be suitable. Residents at Algiers sometimes make use of Hamman R'Irha as a convenient and relatively cool and refreshing summer resort. The neighbouring pine forest is a pleasant feature of the place, the walks are attractive, and longer excursions can be made in the surrounding country.

Oran, on the coast between Algiers and Tangier, is less sheltered than Algiers, and has not the elevated hotels and sheltered walks on the hills which Mustapha Supérieur has. There is a good hotel in the somewhat French-looking modern commercial town. The annual rainfall at Oran is about 16 inches. By railway Oran is 261 miles distant from Algiers. About 2 miles distant to the west are the 'Bains de la Reine,' which were employed during the period of Spanish rule, and received their name from Queen Isabella, the Catholic, who brought her daughter here for the sake of these baths in the sixteenth century. The spring which supplies the baths has a temperature at its source of about 112° F. and contains about 1 per cent. of the chlorides of sodium and magnesium.

Hamman Meskoutin (820 feet), in the Algerian Province of Constantine, with a station on the railway between Bone and

Constantine, has very hot sulphurous springs (up to 203° F.), which can be used in similar cases to those treated by the baths of Hammam R'Irha. The thermal establishment, with moderate accommodation for visitors, is situated in a picturesque mountainous region, covered with heather, evergreen shrubs, and low trees. The French have a military thermal hospital here. By the calcareous deposit from the springs many cones and columns have been produced, varying from two or three to forty feet in height.

Biskra is a collection of villages in an oasis bordering the Sahara desert, to the south of the Lesser Atlas range, at an elevation of about 360 feet above sea-level. It is nearly due south of Marseilles at 34° 55' latitude north, corresponding to the latitude of the southern part of the island of Cyprus. The climate approaches that of the desert, and is drier and sunnier, but doubtless less equable, than that of Algiers. The annual rainfall (about 6·5 inches) is much less than at Algiers, but more than at Cairo (1½ inches). Though rain and the sirocco are rare during winter, there are sometimes terrible storms of wind which raise clouds of dust. In the mountains to the north there is a gorge through which cold winds can blow. The water is so charged with salts that it alters the taste of tea and coffee. Though the accommodation at Biskra is fairly good, the railway journey to get there is, or at least quite recently was, excessively slow and fatiguing (about one day from Constantine and two days from Algiers), and the place cannot be recommended to very delicate or fastidious invalids. About 4 miles from Biskra are the hot baths of 'Fontaine chaude' (HAMMAM SALAHIN, or 'Bath of the Saints'), supplied by a spring having a temperature of 112° F. at the source. They are frequented by Arabs.¹

THE COAST OF MOROCCO

Tangier, the nearest African health resort to England, lies at the western entrance of the Straits of Gibraltar (35° 42' latitude north, 5° 55' longitude west), 35 miles (3 hours by steamer) from Gibraltar. Its climate is probably more under the influence of the Atlantic than of the Mediterranean; it is warm, moist, and equable, the moisture being derived both from the Mediterranean and the Atlantic. The mean annual temperature is 67° F.; and Tangier is said to be somewhat warmer in winter and cooler in summer than Algiers,

¹ For an account of other thermal and mineral waters of Algeria, see 'Etude sur les Eaux Minérales de l'Algérie,' by E. du Pasquier, of Havre, in the *Annales d'Hydrologie*, Paris, 1904, vol. ix.

owing to the humidity of the air. The daily range, however, is considerably larger than that of Madeira. The annual rainfall is 30 to 32 inches, though there are apparently not more than about 35 really rainy days in the year. The old town, which is built on the rocky slope rising from the shore, has the picturesque and antiquarian attraction of preserving its original Moorish characteristics, and has likewise the Oriental disadvantages of densely packed houses, dirty narrow alleys, and crowds of importunate beggars. There is fair accommodation for visitors within and without the town walls.

Mogador, on the north-west coast of Africa, lies at a slightly more southern latitude ($31^{\circ} 30'$ north) than that of Madeira. The prevalent winds are from the north-east, and desert winds are almost completely shut off by the High Atlas range. It is to the influence of the Atlantic and prevalent ocean winds that Mogador owes its extremely equable climate. The mean annual temperature (67° F.) is just above that of Funchal in Madeira (65° F.), but the mean winter temperatures of the two places have been found the same (61° F.). The mean relative humidity has been given as 78 per cent., the number of rainy days as only 44, and the ordinary daily range of temperature as about 5° F., which is even less than that of Funchal. The sky is usually clear. Mogador is apparently more sanitary than one would expect a town in Morocco to be, but the accommodation is, of course, limited. On the hills, about $1\frac{1}{2}$ hours' ride from the town, is the Palm Tree House Hotel, recently enlarged.

CHAPTER V

MADEIRA, THE CANARY ISLANDS, AND THE AZORES

MADEIRA

Madeira, between 32° and 34° north latitude, and between 16° and 17° west longitude, is situated under the full influence of the recurved branch of the Gulf Stream, in the Atlantic Ocean, about 500 English miles from the west coast of Africa. The climate of its chief town, **Funchal**, is generally regarded as the typical one of warm, moist, marine health resorts. Many authors have written on this very equable climate (Mittermaier, Goldschmidt, Grabham, &c.). The mean annual temperature is 65° F.; the mean winter (December to February) temperature, almost 61° F.; the mean January temperature, 60·3° F.; the mean summer temperature, about 69° F.; the mean daily range, about 9·5° F. Mean relative humidity, about 70 to 74 per cent. of saturation. Samler Brown gives the average annual rainfall (17 years) as 26·7 inches. About 85 rainy days in the year (50 or more of them in winter). Clouds are tolerably frequent, but fogs and mists are hardly known except in the mountains. The temperature of the sea is said to vary between 63° and 75° F. (Brown). Funchal is situated in a kind of amphitheatre on the south coast of the island, and the mountains, which rise to about 6,000 feet on the north, shelter it from the prevailing north-east winds. From 7 to 9 o'clock in the morning there is generally no wind; from 9 to 4 the sea breeze blows, and later on in the evening the land breeze descends the ravines. The disagreeable dry E.S.E. wind, termed the 'Leste,' from the Sahara, blows sometimes in March and April, but is rare in winter proper. The steepness of the slope on which Funchal lies is a disadvantage for some persons, but conveyance in sleighs drawn by oxen or in hammocks &c. is easy. The place has been so long used as a health resort that the wants of invalids are tolerably well supplied, and there is always good medical advice to be had. The voyage from England (Southampton) may be accomplished in three days, and from Lisbon in two days.

• The climate is sedative, and the air is pure and free from dust. The effect is beneficial in weak patients with pulmonary emphysema and catarrhal affections of the larynx and bronchi, when there is little expectoration and the cough is troublesome. The tendency to cough is certainly diminished, and the climate is also useful in certain cases of irritable dyspepsia and 'irritable weakness.' In some persons, however, a relaxing (depressing) effect is produced, with loss of appetite and tendency to diarrhoea.

In former days, when a warm equable climate was considered the most suitable one for all cases of pulmonary consumption, Funchal had a much greater climatotherapeutic reputation than it now has. Most phthisical cases require a more bracing place, and the results obtained in ordinary cases have not been particularly encouraging; but there are patients of naturally weak constitution and of the erethic type, with tendency to irritable cough, for whom the climate may still be considered suitable. The same applies to old and emphysematous consumptives, with low resisting powers, and to feeble patients in whom a great amount of lung substance has already been destroyed. It is probable that in carefully selected patients, and with the help of modern 'sanatorium' treatment, better results could be obtained. For many the beauty of Funchal and the sub-tropical vegetation have great charms and exercise a beneficial mental effect. There are cooler places than Funchal for residence during summer, situated amidst pine forests at moderate elevations.

THE CANARY ISLANDS

The Canary Islands are situated between 27° 49' and 29° 46' north latitude, and between 13° 2' and 18° 13' west longitude. They are about a day's voyage south of Madeira and nearer to the African coast. On the whole they are less humid and warmer than Madeira, but there are considerable differences between the various local climates.

Teneriffe, the largest and most important of the Canaries, has likewise the highest mountains, the famous Peak rising to 12,200 feet above sea-level. OROTAVA lies in a valley on the north of the island, facing the open Atlantic, and sheltered behind and on two sides by the mountains; its mountains and coast scenery and its vegetation justify Humboldt's opinion that it is 'one of the most charming spots of the world.' The mean monthly temperatures,¹ beginning with January, are: 61·2° F., 61·6°

¹ See the table calculated from eight years' observations by Perry and Lishman, in Samler Brown's *Madeira and the Canary Islands with the Azores*, sixth edition, 1901, p. 29.

62·6°, 64·0°, 68·3°, 69·8°, 72·5°, 73·3°, 72·7°, 71·2°, 67·1°, 63·7°. Dr. F. Lishman, to whose article in the 'Edinburgh Medical Journal,' Sept. 1898, we are much indebted, points out that the annual variation between the mean temperature of August, the hottest month, and January, the coldest, is 12·1° F. The diurnal variation averages 13·8° F. and is practically the same in summer and winter. The temperature of the sea is 65·7° F. in January, and 73·5° F. in August. Fogs are practically unknown at Orotava, and dew is rarely deposited. The mean annual rainfall is about 16 inches. During bad weather short and heavy showers are the rule, and mostly at night. Rainy days average 59 (on only 30, however, is the rainfall during daytime). The wettest months are usually December and January; practically no rain falls from the end of April to October. The heaviest rains soon disappear, owing to the porous volcanic soil and inclination towards the coast. The prevailing wind is the sea breeze from the north in winter, extremely moderate in force, usually beginning some hours after sunrise, and dying down towards sunset, to be replaced by the gentle land breeze during the night. High winds are uncommon, and, when they occur, are brief. In summer the cool north-east trade wind blows with great regularity, and when it prevails the weather is never oppressive. The hot dry south or east wind, when it occurs, does not usually last more than three days at a time. The so-called 'parasol of clouds' which surrounds the mountain ridge provides a welcome shade during the summer months; it sometimes extends for a distance out to sea, but frequently leaves the coast-line in bright sunshine. According to Samler Brown's table (eight years of observation), the total amount of actual sunshine in the three winter months (December to February) is 459 hours, and in the whole year 2,024 hours. Patients on their way back from South Africa &c. to pass the summer in England, may often with advantage spend part of the spring in Teneriffe or Grand Canary.

The accommodation at Orotava¹ is comfortable, the food good, and the water supply excellent. There is always English society. Lishman says the best level is from 100 to 400 feet above sea-level for ordinary residence between November and June. Cooler and more bracing climates are always within easy reach. Camping out amongst the pines and heather in the higher parts above the cloud-level (about 4,500 feet) is most pleasant and healthy during the summer rainless months.

SANTA CRUZ, on the east coast of Teneriffe, is the chief port and capital of the Canary Islands. Its mean daily winter

¹ The new 'Humboldt-Kurhaus' is about one mile from Orotava.

temperature is slightly higher than that of Orotava, and the total annual rainfall is less.

LAGUNA is situated about $5\frac{1}{2}$ miles from Santa Cruz, at an elevation of 1,840 feet above sea-level. It has a cooler, more bracing climate, and is therefore frequented during summer. The mean daily range of temperature for the eight months (October to May) is 16.6° F. Other localities in Teneriffe at moderate elevations are GÜIMAR (altitude of the English hotel, 1,200 feet), and TACORONTE (1,700 feet). At Güimar, close to the English hotel, there is a sanatorium for the treatment of pulmonary tuberculosis.

VILAFLORE is still higher up (4,335 feet above sea-level), and therefore is cooler and has a somewhat greater daily range of temperature (18.8° F.); it gets more actual sunshine than Orotava.

The island of **Grand Canary** is nearer the African coast than Teneriffe, and the climate is somewhat less moist. At LAS PALMAS, the well-known health resort on the north-east corner of the island, the mean annual rainfall is only 9 inches, whereas at Orotava, in Teneriffe, it is about 16 inches, and on the coast of Palma, nearly the most western of the Canary Islands (under the full influence of the recurved branch of the Gulf Stream), it reaches about 25 inches. Dr. Brian Melland (to whose paper in the 'Medical Chronicle,' 1897, we are much indebted) says the mean relative humidity at Las Palmas during winter may be put down at about 67 per cent. A disagreeable dry east or south-east wind from the African desert occasionally blows during summer. The relatively dry northerly trade wind is the prevailing wind throughout the year. An unusually strong north wind may sometimes be disagreeably cold for invalids, even though the shade temperature be 63° or 65° F. The mean daily temperature (shade temperature of course) for the months October to May inclusive is about 65.4° F. A 'parasol of clouds' girds the central mountains (6,400 feet) of Grand Canary, but Las Palmas is many miles away and has a clear sky and abundance of sunlight. According to Samler Brown's table, Las Palmas gets 512 hours of sunshine during the three winter months, December to February. The hotel accommodation is satisfactory, and there are golf links and a cricket ground. During the rainless summer months it is possible to camp out at higher elevations above the cloud-level. Dr. Melland says the invalid may remain for months in the dry genial climate above the clouds, under a rainless blue sky, with a view which extends to the limit of the horizon. The 'Santa Catalina Sanatorium,' connected with the hotel between the port and the city, is partly reserved for the treatment of consumptives. The beautiful summer resort of the MONTE has an

altitude of 1,300 feet. Dr. Stanford Harris ('Journal of Tropical Medicine,' Aug. 15, 1901, p. 280) considers Monte a suitable spot for a hospital for the treatment of pulmonary tuberculosis.

There is a chalybeate mineral spring in the island and an alkaline earthy 'table water.'

Palma, one of the western of the Canary Islands, has a moister climate, more nearly approaching that of Madeira. Its rainfall is slightly greater than that of Funchal. The scenery of the wooded mountains (the highest points in the island reach 7,700 feet) is very beautiful. There is hotel accommodation at SANTA CRUZ, on the eastern coast—not to be confused with Santa Cruz in Teneriffe.

THE AZORES

These small volcanic islands are situated between $36\frac{1}{2}^{\circ}$ and 40° latitude north, and between 25° and 31° longitude west, far out in the Atlantic Ocean, more than 800 miles from the coast of Portugal, to which they belong. They have a typically equable and insular climate, and with their more northerly position have a somewhat lower mean annual temperature (62° F.) than that of Madeira (Funchal). The daily range of temperature is ordinarily not more than 4° F. Mean annual relative humidity, 76 per cent. Mean annual rainfall, $38\frac{1}{2}$ inches. The winds may be very forcible, and there are frequent storms.¹ The Azores, like Madeira and the Canaries, rise to a considerable height in the interior, the peak of the island of Pico rising to 7,600 feet above sea-level. ST. MICHAEL'S, or SAN MIGUEL, the largest island of the group, possesses thermal springs of various temperatures (some near or at the boiling point) in the LAS FURNAS valley, which are employed in chronic rheumatic affections &c. The valley is the fertile bed of what was once the crater of an active volcano; it is 600 feet above the sea-level, and during summer is frequented by visitors from PONTA DELGADA, the capital of the island, from which it is 27 miles distant. The accommodation for invalids in the Azores is very limited, but there is a simple English hotel at Ponta Delgada. The Prince Line steamers land passengers at Ponta Delgada, a seven days' voyage from New York. From Europe the Azores are best reached by the steamships from Lisbon or Madeira.

¹ See the account of these islands given in Solly's *Medical Climatology*, 1897, p. 441.

CHAPTER VI

THE COAST RESORTS OF THE WESTERN PART OF THE
EUROPEAN CONTINENT¹THE COAST OF THE IBERIAN PENINSULA¹

IN proceeding around the coast of Spain from the north-eastern frontier, the first place demanding our attention is Barcelona.

Barcelona, the chief town of the old Principality of Catalonia, lies at nearly the same latitude ($41^{\circ} 22'$ north) as Rome and the southern extremity of Corsica. Its mean winter temperature is about the same as that of the Western Riviera, and the average number of rainy days is 69, distributed chiefly over spring and autumn. Although the position of this great town is beautiful, the accommodation good, and the neighbouring country interesting and attractive, the place can hardly be regarded as a winter resort for serious invalids. The frequent changes between the cold north-east wind and the hot south wind are very trying to delicate persons. It need scarcely be mentioned here that Barcelona is a very large town, cosmopolitan in character, much of the life and amusements being of the Parisian 'Boulevard' type.

Valencia ($39^{\circ} 26'$ latitude north) has a mild, equable, and sunny climate. Mean annual temperature, 62.6° F. Mean winter temperature, 52.5° F. Mean spring temperature, 57.4° F. Mean relative humidity, 66 per cent. Annual rainfall, about 18.7 inches. Number of rainy days, about 47, distributed, as at Barcelona, chiefly over autumn and winter. In spring and autumn the necessary irrigation of the rice-fields in the neighbourhood has an injurious effect on many persons. The town itself is some little distance from the sea-shore.

Alicante, about 1° latitude south of Valencia, is slightly warmer, and, like the whole of Murcia, has a somewhat drier climate. Mean annual temperature, 64.4° F. Mean winter temperature, 53.5° F. Annual rainfall, 16.9 inches.

¹ We may here mention that there are a few French seaside bathing resorts on the Mediterranean coast between the Riviera and the Spanish frontier, including BANYULS-SUR-MER, picturesquely situated in a small bay, at the foot of the Pyrenees, close to Spain.

Carthagena (37° 35' latitude north), the well-known Spanish Mediterranean seaport, has probably a similar climate, but during winter is often visited by the severe north-west wind. Sudden changes of weather are complained of.

Malaga (36° 44' latitude north, about the same as Algiers), on the south coast of Spain, has a beautiful position on dry sandy soil, facing south-east, and shut in by a semicircle of hills on the north. Mean winter temperature, about 54·5° F.¹ Mean spring temperature, about 64° F. Mean summer temperature, 77·5° F. Mean autumn temperature, about 71° F. Number of rainy days, 40. Though the climate is described as decidedly dry, the mean daily range (in the shade), according to Francis, does not reach 5° F., and this author has spoken of Malaga as the mildest place in Europe. Owing, however, to a defect in the protecting semicircle of hills, the 'terral,' a dry, biting cold north-west wind, something like the 'mistral' of the Riviera, which prevents delicate persons from going out of doors, is often felt during winter. The 'solano' is a south wind from Africa, corresponding to the sirocco in Sicily, but is rare during the winter. The beauty of the surroundings attracts some chronic invalids.

Gibraltar (latitude 36° 7' north) has a moist, equable, sunny winter climate. The mean temperature for the three winter months was formerly given as 54·5° F. (the same as that of Malaga), but it is now stated to be somewhat higher. The number of rainy days is greater than at Malaga. Annual rainfall, about 32 inches. In summer the heat is very trying. Though Gibraltar is a typical crowded, busy garrison town, and cannot be called a health resort, it is frequently visited by persons merely requiring rest and a change of climate, by invalids on their way to and from other health resorts, and by persons returning for their health from India &c. The accommodation has improved, the hygienic arrangements are on the whole satisfactory, and the so-called 'Rock fever' is said to be very rare amongst winter visitors. There is, however, excellent hotel accommodation at **ALGECIRAS**, the Spanish town on the other side of the Bay of Gibraltar.

For convenience we may here mention **RONDA**, an inland town in the mountains, 43 miles from Malaga and about 80 from Gibraltar. Its situation on a plateau, 2,600 feet above sea-level, makes it a bracing place for a change from Malaga or Gibraltar, from the latter of which it can be reached by help of

¹ According to Hann's table (1897) it is higher. Hann gives the mean January and July temperatures for Malaga as 54·9° F. and 80·2° respectively, the corresponding figures for Madrid being 39·9° and 76·1°.

the railway from Algeciras in four hours. It would be a useful resort during spring, early summer, and autumn, were the accommodation quite satisfactory.

Cadiz, which forms part of the so-called Isle of LEON ($36^{\circ} 32'$ latitude north), is considered a very beautiful town, and is situated on a low chalky tongue of land. It has a moist, equable climate. Mean winter temperature, 59° F. Average daily range, about $10\cdot5^{\circ}$ F. Mean relative humidity, 76 per cent. Number of rainy days in the year, about 100. The accommodation is scarcely suitable to serious invalids, though the climate would be beneficial in some early phthisical cases with a weak constitution and a tendency to irritable cough.

San Lucar, at the mouth of the Guadalquivir, 18 miles north of Cadiz, has perhaps a rather drier climate, but the town and surrounding country are not attractive.

Huelva, on the coast a few miles north of San Lucar, has a moist, warm, and equable winter climate, with a daily range of about 10° F. Huelva is about 20 miles from the famous Rio Tinto mines.

Lisbon (latitude $38^{\circ} 42'$ north), the capital of Portugal, has an old reputation, like Constantinople and Naples, of being one of the most beautiful towns of Europe. It is situated on the right bank of the Tagus, about 18 miles from its mouth. Mean annual temperature, 60° F. Mean winter temperature, 51° F. Mean relative humidity, 71 per cent. Annual rainfall, about 29·3 inches. Number of rainy days, about 112. Doubtless owing in part to the winds and the sudden changes in the weather, invalids are now very much less sent to Lisbon from foreign countries than formerly. In the neighbourhood are some attractive localities. **CINTRA**, most beautifully situated at an elevation of about 700 feet above sea-level, at the foot of the Serra da Cintra, is better suited for a stay than Lisbon, from which it is 17 miles distant. The strip of sheltered coast, facing south, including the little fortified town of CASCAES (14 miles west of Lisbon) and the rising climatic resort of MONT ESTORIL, has some claim to be called the **Portuguese Riviera**.

Oporto ($41^{\circ} 9'$ latitude north), the second largest city of Portugal, picturesquely situated on the Douro, 2 miles from its mouth, is likewise used as a winter resort. Mean temperature for January, 49° F. Annual rainfall, about 60 inches, with 115 rainy days. It is now hardly likely to be chosen as a climatic health resort by foreigners, unless for exceptional circumstances.

Further northwards, on the western and northern coast of Spain, are VIGO, CORUNNA, SANTANDER, PORTUGALETE, and **San Sebastian**, all of them under the climatic influence of the

Atlantic Ocean ; they attract visitors from the neighbouring parts during the summer season, on account of their sea-bathing facilities, and beautiful and relatively cooler surroundings. San Sebastian is one of the most beautiful seaside resorts in the world. Its accommodation is excellent, and though its summer season is the fashionable time of year for Spanish and Southern French visitors, it forms an excellent spring and autumn resort for the inhabitants of Northern Europe. The principal hotels, the Casino, and the Royal Palace, line the shores of a sheltered bay, called the 'Concha,' the slopes around which form an almost complete amphitheatre, since even the inlet of the bay on the north is partially protected by the small rocky island of Santa Clara. The beach for bathing in the Concha is of very fine sand.

THE WEST COAST OF FRANCE

Biarritz (latitude $43^{\circ} 29'$ north), in the south-west of France, close to Bayonne, is situated on a picturesque, rocky portion of the coast of the Bay of Biscay, near to Spain. The hotels and villas are situated at various elevations on the cliffs and slopes. Mean winter temperature (December, January, and February), 45.6° F. Mean summer temperature, about 64° F. or higher. Mean spring temperature, about 53° F. The mean relative humidity is said to be about 80 per cent., and the annual rainfall 49.25 inches. Owing to the porous nature of the soil, the ground dries quickly after rain. Biarritz has a rather moist climate, but the prevailing Atlantic winds, to which it is fully exposed, prevent it having a relaxing effect. The climate resembles that of places on the English Channel, but during winter is warmer and rather more sunny, so that more time can be spent in the open air.

Biarritz is well suited to patients requiring a moderately bracing and cheerful place, less exciting than the drier resorts on the Riviera ; but it is too windy for cases of pulmonary tuberculosis and serious invalids. Persons who have a certain amount of cachexia after residence in India and tropical climates can often be recommended to spend some of the colder months of the year at Biarritz, which likewise affords a pleasant change in spring for those who have spent the winter at Arcachon or Pau, from the latter of which it is about 3 or 4 hours distant by rail. -

The accommodation is excellent. During the winter season it is much frequented by the English ; and during the summer months, when it is unpleasantly hot for most inhabitants of Northern Europe, it is thronged with visitors from Spain and the South of Europe. The beach is of fine sand, and the sea-bathing

is excellent. The extensive 'Grande Plage' is fully exposed to the west, but further to the south, and separated from it by the rocky promontory called the 'Atalaye,' is a small isolated bay, shut in by rocks and almost completely sheltered from winds, suitable for delicate persons and those unaccustomed to bathing in the open sea. There are capital facilities for golf at Biarritz.

About ten minutes' walk from Biarritz, on the steam tram-car line between Biarritz and Bayonne, a large bathing establishment has been erected, where brine baths (Soolbäder) of any strength can be obtained, strong muriated waters derived from Briscous being employed for the purpose.

St. Jean-de-Luz, a little to the south of Biarritz, has a similar climate, but is closer to the Pyrenees. It is smaller and less fashionable, and therefore, to some persons, more convenient. Still nearer to the Spanish frontier is the village of HENDAYE, where there is a seaside sanatorium for tuberculous children. On the neighbouring portion of the Spanish coast the seaport of SAN SEBASTIAN, already mentioned, has a fine beach and beautiful scenery; it attracts many visitors from other parts of Spain and from France during the bathing season.

Arcachon (latitude $44^{\circ} 7'$ north) is situated in a sandy district, a good deal north of Biarritz, almost half-way between Bayonne and La Rochelle, and about 34 miles to the south-west of Bordeaux. The vast extent of low-lying country around Arcachon is almost entirely planted with pines, which serve to fix the sandy dunes and prevent the encroachment of the sea. It is mainly on account of the pines that Arcachon has been so often compared to Bournemouth. Arcachon is about 9 miles from the actual coast, and lies at the south of a large basin of salt water, which is only connected by a narrow channel with the sea. Mean annual temperature (Hameau), 58° F. Mean winter temperature, 44.5° F. Mean summer temperature, 68° F. The mean relative humidity is said to be 85 per cent., and the rainfall about 35 inches, with 103 rainy days. Arcachon's reputation as a health resort was acquired during the second half of the nineteenth century, and the Irish physician, Sir D. J. Corrigan, was one of the first to recognise its claims. The winter climate is, on the whole, a mild and sedative one, likely to be suitable, as Burney Yeo has pointed out, in irritable pulmonary cases &c. The villas of the 'winter town' lie amidst the pine trees on the sandy slopes, and are fairly protected from the strong Atlantic winds. The 'summer town,' which is situated along the waterside, is much frequented during the bathing season by the inhabitants of Bordeaux and the neighbourhood.

On the west coast of France, between Arcachon and Brest,

are several places used by the French as summer resorts* on account of the sea-bathing. We need only mention ROYAN, LA TREMBLADE, LES SABLES D'OLONNE, PORNIC, and LE CROISIC. Near Le Croisic, at PEN-BRON, there is a charitable establishment for weakly children, and at LA BAULE, on the railway between Paris and Le Croisic, there is a sea-coast sanatorium (Institut Verneuil) for paying patients, specially designed for debilitated persons and delicate children, where the education of the children, as well as their physical condition, can be attended to. At SAINT-TROJAN, in the island of Oléron, the 'Œuvre des Hôpitaux Marins' have one of their excellent establishments for poor children.

THE NORTH-WESTERN COAST OF EUROPE

The north-west coast of France, especially **Finistère**, in its climate somewhat resembles the south-west coast of England. The naval port of BREST (latitude 48° 23' north) may be fairly regarded as a climatic representative of the north-western corner of France. Its mean annual temperature is 53° F. Mean winter temperature, 44·2° F. Mean spring temperature, 51·2° F. Mean summer temperature, 62·8° F. Mean autumn temperature, 53·8° F. Mean annual relative humidity, about 79 per cent. The mean annual rainfall is nearly 30 inches, and the number of rainy days about 175. The south-west and western winds from the Atlantic are the most frequent.

The **northern coast of France** (Normandy &c.) has a drier climate than that of Brest. On it are situated many popular summer resorts, some of which are very fashionable during the height of the season (June to August). On the north coast of Brittany (proceeding from west to east) are situated ROSCOFF, TRÉGUIER, PAIMPOL, DINARD, and ST. MALO. Dinard is popular with English and American families, as is also the neighbouring interesting old town of DINAN, which lies about 14 miles inland, amidst beautiful scenery; St. Malo, a fortified town, lies on a little peninsula on the opposite side of the mouth of the Rance, and is connected with Dinard by steam ferry. The neighbouring portion of Normandy, with the picturesque old fortified rock of MONT ST. MICHEL, is very much visited by French and English tourists during summer. AVRANCHES, near the coast, opposite to Mont St. Michel, has a healthy position on a hill, whence beautiful views towards Mont St. Michel and the surrounding country are obtained; it is considered a pleasant place of residence by many, notably for English families of limited

means. From the bay of Mont St. Michel the coast-line turns northwards to the Cap de la Hague, and about 14 miles north of Mont St. Michel is situated GRANVILLE, a picturesque place with good sea-bathing.

Opposite this portion of the coast (Department of Manche) are the British possessions of JERSEY and GUERNSEY and the other **Channel Islands**, which we may conveniently refer to in this place instead of with England. Jersey is 16 miles from the French coast, and Guernsey is 18 miles to the north-west of Jersey. The Channel Islands, which have belonged to England since the time of William the Conqueror, lie between latitudes $49^{\circ} 10'$ and $49^{\circ} 42'$ north and between longitudes $2^{\circ} 2'$ and $2^{\circ} 40'$ west. They have a moist marine climate and are much exposed to winds. In Jersey the mean temperature for spring is 48.7° F.; for summer, 60° F.; for autumn, 53° F.; for winter, 43° F. Guernsey has a slightly colder spring than Jersey, but both islands, as compared with the average of the British Isles, have a more equable temperature, with a warmer winter and a slightly cooler summer. The Channel Islands are apparently somewhat sunnier than the sunniest places in Great Britain proper. Thus, according to tables published in 1897 by the English Meteorological Office, Hastings gets 40 per cent. of the possible sunshine, whilst Guernsey gets 42 per cent. and Jersey 44 per cent. Jersey has 1,930.5 hours of bright sunshine in the year, which is 169.4 hours more than Hastings has. The mean relative humidity at Guernsey (taken at 9 A.M.) for the various months appears to range from 82 to 89 per cent. The average annual rainfall for Jersey and Guernsey is about 32 to 34 inches, distributed over 170 to 180 rainy days. The prevailing winds are westerly and south-westerly, excepting during the spring, when the east and north-east winds may be troublesome to persons with a tendency to respiratory affections. Old age appears to be exceptionally frequent in these islands, and the general development of the children unusually good. Drs. Symes Thompson and Lazarus-Barlow¹ write: 'There are many cases in which the voyage to Madeira or the Canaries seems too great or costly an undertaking, in which the short trip to the "Norman Archipelago" will suffice; nevertheless, it must be remembered that the passage to the Channel Islands is often very rough, and hence inadvisable for old and debilitated persons, while the straining of sea sickness during the voyage has, in our own knowledge, been the exciting cause of cerebral apoplexy in subjects of chronic granular kidney. The fact remains, however, that within seven

¹ *The Climates and Baths of Great Britain*, Report published by the Royal Medical and Chirurgical Society of London, 1895, p. 104.

or eight hours¹ of London a winter haven is to be reached where camellias and rhododendrons flower in the open in February, where frost is rare, and lasting snow unknown.' The chief resorts in the Channel Islands are ST. HELIERS, on the south coast of Jersey, and ST. PETER'S PORT, situated on the side of a hill on the east coast of Guernsey. The interior of Jersey is more wooded and picturesque than that of Guernsey. In the middle of the BAY OF ST. BRELADE (Jersey), on rising ground, facing south, is a sanatorium for the open-air treatment of pulmonary tuberculosis.

Further along the French coast, 18 miles to the east of the Cap de la Hague, and nearly due south of the western extremity of the Isle of Wight, is CHERBOURG, the great naval port of France, which is likewise visited for its sea-bathing during the summer months. Mean temperature for July, 62·8° F.

Near the estuary of the Seine is a group of seaside summer resorts consisting of CABOURG-DIVES, HOULGATE-BREUZEVAL, VILLERS-SUR-MER, and the fashionable TROUVILLE and DEAUVILLE. Trouville, at the mouth of the Touques, formerly a small fishing village, was first brought into notice by the elder Dumas, and is now one of the most visited French summer resorts. It has fine sands for bathing, a large casino, and facilities for hydrotherapeutic treatment. The life during the season is typical of fashionable French seaside places.

On the eastern side of the estuary of the Seine, between Havre and the mouth of the Somme, are ETRETAT, FÉCAMP, ST. VALÉRY-EN-CAUX, DIEPPE, and LE TRÉPORT-MERS. ETRETAT, distinguished for its picturesque scenery, has in quite recent times been converted, owing to the patronage of French artists, from a small fishing village into a much visited seaside resort. The chalk cliffs on either side of Etretat reach the height of 270 feet. The seaport of FÉCAMP lies in a valley between high cliffs; the mean temperature for August, the hottest month, is 63·6° F. DIEPPE and TRÉPORT are the nearest seaside resorts to Paris, and therefore both receive many Saturday to Monday visitors from the capital, besides those who come to stay for longer periods. Both resorts have shingly beaches and precipitous chalk cliffs, somewhat like those of Dover in England. There are several interesting objects for walks and excursions in the neighbourhood.

Between the mouth of the Somme and Boulogne is BERCK-SUR-MER, with several sanatoria for scrofulous children. It lies on sand dunes, like some of the resorts on the Belgian coast, and so fine is the sand that a moderate wind can blow it up in clouds.

¹ Ordinary journeys from London to Guernsey take nine hours; to Jersey eleven hours.

At the south end of the 'Plage' is the enormous barrack-like sanatorium of the 'Assistance Publique de Paris,' which was inaugurated in 1869, and is probably the largest seaside sanatorium for children in the world, holding between 700 and 800 children. Berck is not picturesque or beautiful, and is rather a place for real invalids than a mere seaside holiday resort. Near to Boulogne, at the mouth of the Canche, are the newer resorts of LE TOUQUET and PARIS-PLAGE.

BOULOGNE and CALAIS are naturally much visited by the English, since they are the nearest French towns to England. Boulogne is generally preferred for a holiday, and its gay casino and the shore to the north of the harbour present a lively scene during the season. There are facilities for warm sea baths &c. The 'Old Town' or 'Haute Ville,' on an eminence surrounded by its well-preserved ancient ramparts, is a great historical curiosity, which rivals anything of the kind to be seen in England. DUNKIRK (Dunkerque), likewise of great historical interest to the English, has a much frequented seaside bathing place (MALO-LES-BAINS), with an extensive sandy beach, about half a mile from the old town.

Ostend (latitude 51° 14' north), in Belgium, is one of the most visited seaside resorts in the world. It has an excellent sandy beach for bathing, and the 'Digue,' constructed on the sand dunes, forms an excellent promenade in front of the large hotels and villas facing the beach. The attractions of the large casino (Cursaal) and the gay life of the place bring crowds of pleasure-seeking tourists to Ostend and considerably increase the expense of accommodation. Mean temperature for July, 64·8° F.

In the neighbourhood between Ostend and Dunkirk are the smaller, less developed, and cheaper Belgian seaside resorts of MARIAKERKE, MIDDELKERKE, and NIEUPOORT-BAINS; these places are situated on dunes, and have sandy beaches like that of Ostend. BLANKENBERGHE, about 11 miles to the east of Ostend, has handsome villas and hotels on its digue, and a beach resembling that of Ostend, which place it almost rivals in popularity and gaiety. HEYST, 5 miles further east, and KNOCKE, 2 miles beyond Heyst, have similar situations, but are much less pretentious. Knocke is in fact only commencing as a health resort. All these Belgian coast places have a decidedly refreshing climate, with a fair amount of wind.

Scheveningen (latitude 52° 7' north), the well-known seaside health resort of Holland, is mostly built along the dunes, like Ostend and the seaside resorts of Belgium. It has not got the same imposing digue, levelled and paved with tiles, as Ostend has, but there is a fine long undulating promenade on the dunes

in front of the villas and hotels which face the sea. Scheveningen is only about 2 miles from The Hague, with which it is closely connected by tram-lines. Warm sea-water baths and hydrotherapeutic treatment may be obtained at the thermal establishment close to the Cursaal. Scheveningen rivals Ostend and Blankenberghe in popularity, and enjoys the advantage of having two beautiful parks (those of Scheveningen and The Hague) with shady promenades where persons may walk or rest during hot weather or when they get tired of the sea-shore and the dunes. According to Dr. W. Francken,¹ during the season of 1898 the mean midday temperatures of the sea and air were found to be respectively 61.7° F. and 63.5° for June, 63.5° and 61.7° for July, 67.1° and 69.8° for August, 66.2° and 67.1° for September. There is a good deal of wind.

ZANDVOORT, further north of Scheveningen, is a similar seaside resort, but smaller and more recently developed. It is reached by train from Haarlem in 20 minutes. HAARLEM itself, about four miles from the coast, has a beautiful park and muriated chalybeate waters. About three miles north-west of Haarlem are the beautiful woods and country villas of BLOEMENDAAL, separated by high sandhills ('dunes') from the shore. The neighbouring estate of DUIN-EN-DAL (dune and dale) now offers good hotel accommodation.

THE GERMAN NORTH SEA RESORTS

Germany possesses many bracing seaside resorts on the North Sea, amongst which we should first mention the small **East Frisian Islands** of BORKUM, JUIST, NORDERNEY, BALTRUM, and WANGEROOG. The most popular and best developed of these is probably Norderney, which can be reached by steamers in a little more than half an hour from the railway station of Norddeich.

The island lies in latitude 53° 44' north, and is about 8½ miles long and 1½ miles wide. It has, on the whole, a breezy, refreshing climate, though during the height of summer, excepting along the shore, the heat may sometimes seem oppressive. Mean temperature for the three summer months is said to be only 54.6° F. Annual rainfall, about 36½ inches. The village, with its bright-looking modern villas and hotels, is at the west end of the island, and affords excellent sea-bathing. It has likewise an establishment where warm sea-water baths &c. may be obtained. The sandy dunes, which constitute the surface of the island, have a very bare appearance, but a small plantation and avenue on the

¹ Francken, *Scheveningen, sa Plage, ses Bains*, published at The Hague, 1899.

south of the village offer a certain amount of shade, and may, for a change, be preferred to the sea-shore promenades. The custom at Norderney and German seaside resorts, unlike that at French places, is for ladies and gentlemen to bathe apart at separate portions of the shore specially reserved for this purpose. At Norderney there is an excellent sanatorium ('Seehospiz Kaiserin Friedrich') for scrofulous and weakly children of the poorer classes; it is the largest of the marine sanatoria belonging to the 'Society for Children's Sanatoria at German Seaside Places.'

The island of **HELIGOLAND** (Helgoland), belonging since 1890 to Germany, lies in latitude $54^{\circ} 12'$ north, about 46 miles from the mouth of the River Elbe. It has a thoroughly marine climate and excellent bathing. Mean temperature for June, 56.5° F.; for July, 60.6° F.; for August, 61.5° F.; for September,

F. The daily range is said to be not more than 6° F. This little island, which is only about one-fifth of a square mile, consists of an elevated triangular plateau (Oberland) with steep cliffs rising to 180 feet above sea-level, and a smaller, low-lying portion (Unterland). Heligoland is thronged by visitors during summer, especially from North Germany. Steamers reach it in about 3 hours from Cuxhaven or Bremerhaven.

Further north are the **Schleswig Islands** (North Frisian group), of which **FOEHR** and **SYLT** are popular summer resorts for North Germany. Sylt is the largest of the Schleswig Islands, and **WESTERLAND** (latitude $54^{\circ} 54'$ north), in the middle of its west coast, is its chief bathing place. The climate is thoroughly bracing. Mean temperature of the air during the summer months is about 58.8° F.; mean temperature of the water, about 70° F. **WYK**, on the south-east coast of the island of Foehr, is a somewhat less bracing place, and has more foliage than most German North Sea resorts. The island of **AMRUM**, with the resorts of **WITTDÜN** and **SATTELDÜNE**, is to the south-west of Foehr.

Amongst North Sea resorts on the Mainland of Germany we may mention: the great naval port of **WILHELMSHAVEN** (for persons who like to see the shipping); **DANGAST**, in Oldenburg, not far from Wilhelmshaven; **CUXHAVEN**, at the mouth of the Elbe, the port of Hamburg; and **BÜSUM**, in Holstein.

THE BALTIC HEALTH RESORTS OF GERMANY

In this group we will mention **Düsternbrook**, a suburb of Kiel; **Travemünde**, near Lübeck; **Heiligen-Damm** (close to Doberan), and **Warnemünde**, both near Rostock; **Sassnitz** (including

Crampas), Binz, Lauterbach (near Putbus), and some other places on the island of Ruegen; Heringsdorf (with the adjoining Ahlbeck), Swinemünde, Misdroy, and Dievenow, all to the north of Stettin, at the mouths of the Oder; Kolberg (or Colberg); Ruegenwalde; Zoppot and Westerplatte (near Danzig); and Cranz (near Königsberg).

DÜSTERNBROOK, the northern suburb of the great naval port of Kiel, lies on the western bank of the inner portion of the bay (harbour) of Kiel. There are a few bathing establishments, but no regular beach, as on the open sea. The walks in the wood of Düsternbrook are very beautiful. At ALTHEIKENDORF, on the opposite (eastern) bank, half an hour by steamer from Kiel, there are likewise arrangements for bathing.

TRAVEMÜNDE was the port of Lübeck before the river to Lübeck was deepened. It lies on the left bank of the mouth of the Trave. There are beautiful trees and shady walks close to the shore. About $2\frac{1}{2}$ miles to the north-west of Travemünde is the new and less developed summer resort of NIENDORF, and still further off is WILHELMINENBAD.

DOBERAN is a rather quiet place in Mecklenburg-Schwerin, and is much valued as a summer resort by Mecklenburg families. Beautiful walks through a beech wood lead to HEILIGEN-DAMM, which is the actual bathing place of Doberan, and about $3\frac{1}{2}$ miles distant.

WARNEMÜNDE, on the left (western) bank of the mouth of the Warnow, is the port of Rostock, from which it can be reached in about half an hour by train. There are not the shady walks in the woods to be had at Warnemünde, which can be enjoyed during the hot summer days at most of the other Baltic resorts. The beach is of fine white sand, so that in July the heat and glare may sometimes be intense. To many children, however, and to grown-up persons also, the ships entering and leaving the river are a great source of interest.

SASSNITZ (including the adjoining village of CRAMPAS), one of the most beautiful places of the Baltic, is situated on hilly ground on the east of the **Island of Ruegen**. The beach is of rather coarse shingle, and the waves may be forcible during an east wind. To the north of Sassnitz is the beautiful forest of Stubbenitz, which consists almost entirely of beech trees and covers the whole of the eastern portion of the Peninsula of Jasmund. At a spot called the Stubbenkammer, 7 miles to the north of Sassnitz, the chalk cliffs attain the height of 435 feet, rising almost perpendicularly from the sea, like the famous Shakespeare Cliff (350 feet), near Dover, Flamborough Head (450 feet), near Bridlington, and Beachy Head (515 feet), near Eastbourne; the

walk in the forest of Stubbenitz, close to the edge of the cliffs, from Sassnitz to the Stubbenkammer, is one of the most beautiful that can be enjoyed at any seaside resort in Europe. BINZ, on the bay to the south of Sassnitz, is likewise prettily situated and much frequented, and close to it is the beautiful deer park called the Granitz. PUTBUS, in the south of the island, has its sea-bathing place at LAUTERBACH, $1\frac{1}{2}$ miles distant.

HERINGSDORF, AHLBECK, and SWINEMÜNDE lie close together on the northern coast of the island of **Usedom**, one of the two islands at the mouth of the Oder, to the north of Stettin. These places have a broad level beach of fine white sand, constituting a natural promenade which connects them together. Heringsdorf is considered the most fashionable seaside resort on the Baltic, and has therefore sometimes been called the 'Ostend of the Baltic.' It has fine villas and hotels well suited to such a place, but, unlike Ostend, it can boast of shady woodland (beech, oak, pine) close to the sea. Swinemünde consists of two portions, a harbour portion along the Swine, and a coast portion facing the Baltic; between the two portions is a beautiful forest of beech. In 1896 muriated mineral springs were discovered in this wood, and a fine bathing establishment has been erected close to the harbour portion of the town, with arrangements for brine baths (Soolbäder), moor baths, and a swimming bath of sea water &c.

Further to the east, on the north coast of **Wollin**, one of the two islands at the mouth of the Oder, is MISDROY, with pleasant villas and hotels facing the sea, and a sandy beach similar to that of Heringsdorf and Swinemünde. There are beautiful beech woods on the neighbouring slopes.

DIEVENOW is a secluded, rather homely, summer resort, divided into three portions, the chief of which is BERG-DIEVENOW. It is reached by steam ferry from CAMMIN, a picturesque, ancient-looking little town, which is connected by railway with Stettin. Both Dievenow and Cammin possess brine springs.

Further along the coast, eastwards of Stettin, are KOLBERG and RUEGENWALDE, both of which have arrangements for brine baths as well as sea-bathing.

ZOPPOT, about a quarter of an hour by train from Danzig, has a beach of fine white sand immediately adjoined by shady plantations. Behind these are the villas and hotels of the health resort, and inland of these is a range of wooded hills running nearly parallel to the shore. The Carlsberg, at OLIVA, a village a few miles from Zoppot, attains a height of 350 feet, and commands a magnificent view of the whole surrounding district. Zoppot is much resorted to during summer by families from

Danzig, Stettin, Berlin, &c., as well as by some from Poland and Russia. WESTERPLATTE, at the mouth of the Weichsel (Vistula), has pleasant shady woods adjoining a beach of fine sand, as at Zoppot. It can be reached by steamer from Danzig in a few minutes, and is therefore often thronged with excursionists from Danzig, who come to spend the afternoon and evening there.

KRANZ, the most easterly Baltic health resort of Germany, somewhat resembles Zoppot, and is about one hour by railway from Königsberg.

All these Baltic resorts (called Ostseebäder by the Germans) lie between 53° 50' and 55° latitude north, and between the July isothermal lines for 60° F. and 70° F. The average summer temperature of the whole coast-line is probably about 62° F. to 63° F., and there is a good deal of bright clear weather. In summer the climate is somewhat less windy and less bracing than that of the North Sea coast. The mean relative humidity in summer appears to be slightly over 72 per cent. (Heringsdorf and Misdroy). The winter climate of the coast, especially of the more eastern portion, is a cold one; at Memel, the most easterly town of the German Baltic coast, there is a difference of nearly 37° F. between the mean monthly temperatures for July and January. 'The curving round of the January isothermals of 30°, 20°, and 10° upon the regions surrounding the Baltic is to some extent due to the freezing of the shallow brackish waters of that sea during winter. Had the Baltic been deeper and saltier, and not subject to freezing, the winter climate of places round its coasts would have been much less severe.'¹ The following figures, quoted from Hann, may be given as specimens of the temperatures of this region:

	Mean annual temperature	January	July
Swinemünde	45.7° F.	30.2° F.	63.3° F.
Putbus (island of Ruegen)	45.5° F.	30.8° F.	62.6° F.
Memel	43.9° F.	26° F.	62.8° F.

The climate of the Baltic coast is less distinctly marine than that of the North Sea, and in some respects resembles that of large inland lakes. In regard to the sea it must be observed that there is no tidal ebb and flow; the water is less salt, and the wave movement usually slighter, than on the North Sea and Atlantic coasts. Whilst the Mediterranean has about 30 to 40 parts of salt in 1,000 parts of water, and the North Sea and the Atlantic Ocean about 30 parts, the Baltic water has only 4 to 20 parts; the saltiest portion of the Baltic is that nearest to the North Sea; at Heringsdorf the sea water contains about

¹ A. Buchan, *Introductory Text-book of Meteorology*, 1871, p. 72.

10 parts of salt in the thousand. The mean temperature of the sea water at the Baltic resorts during the summer months is about 61° F. to 62° F., slightly less than that at the German North Sea resorts, and several degrees lower than that at the resorts on the English Channel. At the Baltic resorts the sea attains its highest and pleasantest temperature for bathing (about 66° F. or higher) in August.

At all the German Baltic spas, sea-bathing is only permitted at the regular establishments which have been erected for the purpose. They are large wooden structures projecting into the sea, and resembling the bathing establishments commonly employed for open-air bathing in inland lakes. Each health resort has at least two such establishments, one for ladies and one for gentlemen, some distance apart from each other. The times at which the establishments are open for use are fixed by the local authorities. No independent bathing is permitted (at least during the bathing season) on the coast or from boats.

The forests near the coast form a special feature of the Baltic resorts, and not only afford protection from the sun during hot weather, but add considerably to the beauty of the scenery. At some places, such as Zoppot, shady plantations immediately adjoin the shore.

Several places along the coast possess brine springs, which can be employed for baths before, or in some cases instead of, sea-bathing. Thus, Kolberg, Cammin, Dievenow, Swinemünde, and Greifswald possess brines (Soolen) of strengths varying from 2 to 5 per cent. The thermal establishment connected with the brine springs of Swinemünde is quite modern and complete in its arrangements.

At GROSS-MÜRITZ in Mecklenburg-Schwerin, and at ZOPPOT, it may be mentioned that there are charitable sanatoria for scrofulous and weakly children of the poorer classes.

RUSSIAN BALTIC RESORTS

RIGA (latitude 56° 57' north), the capital of Livonia, has a mean July temperature of 65·7° F. The mean temperature of the sea for the same month is about 66° F. KEMMERN, not far from Riga, is much visited for its cold sulphurous springs and peat baths. ARENSBURG, on the south-east coast of the island of Oesel, is much frequented, and is chiefly known for its mud baths. PERNAU, in Livonia, on the north-eastern shore of the Gulf of Riga, and HAPSAL, in Esthonia, are visited during summer for their sea baths and their mud baths. At these places the kind of baths termed 'diluted mud baths' are much employed, the action

of which doubtless more nearly approaches that of baths of water than that of the semi-solid peat baths given at some health resorts. The mud at most of the Russian Baltic resorts comes from the sea, but at Pernau it is obtained from boggy ground.

REVEL, in Esthonia, and HELSINGFORS, the capital of Finland, opposite to each other on the Gulf of Finland, and the ALAND ISLANDS, at the mouth of the Gulf of Bothnia, have good sea-bathing.

We may here likewise mention the sanatoria for poor consumptives near the HALILA LAKE, in Finland, and the LINDHEIM SANATORIUM (300 feet), in Livonia, though the latter is far inland.

SCANDINAVIAN SEASIDE RESORTS

In Denmark, KLAMPENBORG and SKODSBORG, near Copenhagen, are popular resorts; on Sundays, however, during summer, Klampenborg and its beautiful Deer Park ('Dyrehave') are quite overrun by thousands of visitors, mostly of the poorer classes. MARIENLYST is a pretty suburb of Helsingör, from which it can be reached by a few minutes' walk. A little further along the coast, to the north-east of Marienlyst, is HELLEBEK. The VEJLEFJORD SANATORIUM (opened in 1900), on the Danish mainland, near Vejle and Fredericia, is one of the finest establishments of its kind, that is to say, for the treatment of pulmonary tuberculosis. There are now several other sanatoria for consumptives in Denmark. There is a seaside sanatorium for scrofulous children at REFSNAES, which was founded by Dr. Engelstad many years ago, and there are several similar establishments on other parts of the coast which have been founded since then.

MARSTRAND, on a small island in the Kattegat, 22 miles north-west of Gothenburg, is a fashionable Swedish summer resort.¹ At FLYRSÖ, near Gothenburg, is a seaside sanatorium for scrofulous children. On the Swedish coast, about 26 miles north of Marstrand, is LYSEKIL, another popular seaside place; further north, on the Skager-Rak, near the Norwegian frontier, is STRÖMSTAD, noted for its mud baths. Still further north, in Norway, on a small island a few miles from Fredrikstad, is the HANKÖ 'Kyst-Sanatorium,' a $4\frac{1}{2}$ hours' journey to the south of Christiania. LAURVIK and SANDEFJORD, situated on 'fjords' on the opposite (Norwegian) coast, have mud-baths like

¹ The Loka mud-massage treatment can be employed at Marstrand with mud obtained from Loka. (See Chapter VIII.)

those of Strömstad, and likewise sulphurous and chalybeate mineral waters. FREDRIKSVÆRN, near Taurvik, and HAGEVIK, near Bergen, may be mentioned as Norwegian seaside sanatoria for scrofulous children.

RONNEBY, on the Baltic coast of Sweden, near Carlskrona, is a well-known health resort, with sea baths, chalybeate waters, and mud baths.

THE COLDER ISLAND CLIMATES

Amongst the colder islands which may be visited by persons of strong constitution who need rest and recreation after overwork &c. are the HEBRIDES, the ORKNEY ISLANDS, the SHETLAND ISLANDS, the FARÖE ISLANDS, and ICELAND. Parties are even made up for the voyage to Spitzbergen. We shall here content ourselves with giving a short note on the climate of Iceland.

Iceland can hardly be classed amongst health resorts, but the voyage there and back and an excursion in the island may be of use during summer to many persons who like sea voyages, and who, although of strong constitution, are suffering from the effects of mental overwork and prolonged town life. The interest and mental recreation afforded by such a trip have much to recommend it, and the attractions of modern Iceland from the health-giving point of view formed the subject of some entertaining lectures¹ delivered by Dr. W. Lauzun-Brown before the Royal Institution of Great Britain in May 1899. Iceland lies between $63\frac{1}{2}^{\circ}$ and $66\frac{1}{2}^{\circ}$ latitude north, and to the west side of the warm Gulf Stream. The ocean influence and the prevalence of the relatively warm easterly winds explain the fact that, though the northern coast of Iceland touches the Arctic Circle, the mean annual temperatures of the different parts of the island are included between 32° and 40° F. (Hann, 1897). The climate is therefore equable, and the winters are relatively mild. In July the mean temperature of the south-west coast reaches $51\cdot8^{\circ}$ F. The greatest difference between the mean temperature for the different months is about $14\cdot5$ F. on the north, the east, and the south coasts, and reaches 27° F. quite in the interior of the island. Rain and storms are most frequent during autumn and winter; nearly half the storms of the whole year occur during December and January. The proportion of cloudy weather is great. The annual fall of snow and rain (least amount in spring) is over 39 inches in the south of the island, $23\cdot5$ to $31\cdot5$ in the west and apparently hardly $15\cdot75$ inches in the north (Hann).

¹ Printed in the *Physician and Surgeon*, London, March to May, 1900.

CHAPTER VII

INLAND EUROPEAN RESORTS—SWITZERLAND

AMONGST the inland resorts of Europe, spas (that is, mineral water health resorts) occupy quite as important a position as climatic health resorts proper ; but since the ordinary treatment at spas is chiefly by mineral waters and baths, we can only briefly allude to them in this Part, and must refer readers to Part II for an account of the action of the various classes of mineral waters and baths.

HIGH ALTITUDE RESORTS OF SWITZERLAND ¹

Amongst Swiss health resorts we must first consider those of high altitude, especially the winter resorts of high altitude, some of which have attained a higher stage of development than mountain resorts in any other part of the world. In Chapter II of this volume we have already described the general physiological and therapeutic effects of climates of high altitude, and in Part III we shall further define the main indications for high altitude resorts in various diseases and morbid conditions. The use of high mountain valleys in Switzerland as winter resorts may be said to date from about 1865, a good many years after Archibald Smith ² had pointed out the value of the high mountain valleys of the Peruvian Andes in cases of pulmonary tuberculosis. About this time the subject was taken up by various medical men, and not long afterwards knowledge as to the winter climate in the Swiss mountains began to be disseminated in England by the writings of such laymen as John Addington Symonds and A. W. Waters. Before this the popular belief was that during the winter months the high mountain valleys were sunless regions of ice and snow and fog and wind. After this date the bright winter days in the mountains began to get talked of, when the sun is so hot and the air so still that persons can sit out-of-

¹ As high altitude resorts in Switzerland we include those over 3,500 feet above sea-level (*vide* Chapter II).

² See especially 'Practical Observations on the Diseases of Peru,' in the *Edinburgh Medical and Surgical Journal*, 1840, vol. liv. pp. 5-13.

doors during the greater part of the day and even require a protection from the great light and heat of the sun.

During the winter season (the five months November to March), the mean temperature in these resorts is between 20° and 30° F.; the mean relative humidity, 60 to 80 per cent. of saturation; and the number of rainy or snowy days about 50 to 60. The amount of sunshine during the colder months, reckoned as the percentage of the possible sunshine (at Davos for the seven months, October to April), is about 56 per cent.; but the amount of possible sunshine differs considerably in different places. Davos-Platz and Davos-Dörfli are both on the sunny side of the valley, but a depression in the surrounding mountains allows the sun to shine slightly longer on Davos-Dörfli than on Davos-Platz. Places situated high up on the sunny sides of valleys or on elevations in valleys naturally have a longer duration of possible sunshine than those situated in the deeper parts. Thus, the upper portion of Arosa gets more sunshine than the lower portion of Arosa, and Wiesen, St. Moritz-Dorf, and Leysin get more sunshine than the two Davoses, both of which lie only slightly above the level of the valley. Leysin, which lies high up on a slope with an open outlook towards the south, has $7\frac{1}{2}$ hours possible sunshine in December, whilst Davos has only about $5\frac{1}{2}$. If we compare the amount of actual and possible sunshine at the Swiss mountain resorts with that at the sunniest winter resorts of Great Britain, we find that Davos-Platz has a monthly average of about $102\frac{1}{2}$ hours ($58\frac{1}{2}$ per cent. of the possible) for the three winter months, whilst Hastings has only about $67\frac{1}{2}$ hours (26 per cent. of the possible), and Torquay about $61\frac{1}{2}$ hours (24 per cent. of the possible).

The contrast between the cold in the shade and the warmth in places exposed to the sun is very great. Sir H. Weber gives a difference of 70° F. between the mean maximum temperature in the sun and the mean maximum temperature in the shade for December at Davos. Since the sun temperatures are so high, it is easy to understand how, with a mean monthly temperature of about 20° F. and a mean maximum temperature (in the shade) of about 36° F., persons can feel warm when sitting still in the open air watching the skating, and how a sunshade may often be agreeable. J. A. Lindsay says: 'It may seem almost incredible that with the thermometer below freezing-point in the shade patients should sit for hours upon an exposed balcony with perfect impunity; that they should require sunshades although clothed in furs; and actually suffer from heat while the breath freezes upon the moustache; yet such are the seeming anomalies of Davos.' Even in the shade and when the sun has set, the dryness

and stillness of the air prevent the low temperature from being felt so much as it would be at low elevations. The stillness of the air enables the windows to be kept widely open during the night, and greatly facilitates the carrying out of the open-air treatment. The freedom from troublesome winds and dust in the high Alpine valleys is certainly a point in their favour, when we compare them to other sunny winter resorts, such as those of the south of Europe and Egypt.

During winter the ground is generally covered by 6 to 24 inches of snow, and this covering helps to keep the air free from dust, and, by reflecting the solar rays, increases the brightness and warmth in the sunshine. The time when the snow covering commences and the time when it begins to melt vary, of course, at different places, and also at the same place in different years. The seasons of different years differ from each other in the high mountains as everywhere else. At Davos the ground generally commences to receive its permanent winter covering of snow towards the end of November or beginning of December, but this may be delayed till January, and the melting generally begins in the first half of March. At Les Avants, which is lower than Davos, the duration of the snow covering is shorter, and it has generally disappeared by the beginning of March. Patients, if the maximum winter stay is required, should arrive between the end of September and November in order to become acclimatised before the great winter snowfalls take place. The snow-melting period sometimes extends over several weeks, and is accompanied by much moisture, frequent changes of the temperature, and occasional violent winds. Coryza, coughs, and sore throats frequently occur at this time, and great caution has to be observed by delicate patients. In many cases it is the best for patients to keep where they are, because all climates at this season have their drawbacks, and a journey may be attended by greater risks than remaining in the mountains. The individual case, however, must be considered, and sometimes there can be no grave objection to a change of climate, whilst occasionally the mental condition of the patient may render it even advisable. In the latter event a change may be recommended to such places as Ragatz, Seewis, Thusis, the Hôtel Dolder, near Zürich, Glion or Les Avants, above Montreux, Locarno, and other places on the Italian lakes.

Before describing the individual resorts, we may shortly consider the *main points in which high mountain localities of Switzerland differ from those of the Rocky Mountains, the Andes, the Himalayas, and the South African tableland*. Most of the Swiss stations are more shut in and have a rather moister and

colder climate, but less wind and dust than the stations in the Colorado Rocky Mountains. At *Colorado Springs* snow lies only for a few days during winter, and there is no troublesome snow-melting period as at the Swiss resorts. The limit of vegetable growth is much lower in Switzerland than in the Rocky Mountains, and no apples and other fruits will ripen at St. Moritz and Davos as they will do near Denver. Denver (5,280 feet) and Colorado Springs (6,000 feet) have a greater possible and a greater actual amount of sunshine than Davos-Platz.¹ At Colorado Springs, however, Solly states that severe and exceedingly disagreeable wind or dust storms occur six times or so in the year. On the other hand, the high altitude resorts in the tropical portion of the *Andes*, owing to their geographical position near the equator, differ considerably in their climates both from the resorts in the Swiss Alps and from those in the Rocky Mountains of the United States. Thus equability is a striking feature of the climate of the Jauja Valley of the Peruvian Andes; day and night, summer and winter, the temperature is said not to vary much more than 10° F. during the whole year (absolute annual range). At Huancayo, a town in the Jauja Valley, according to Archibald Smith, the temperature in the shade ranges from 50° F. to 63·5° F., and at the slightly cooler town of Jauja (10,000 feet above sea-level) the temperature was observed to remain between 50° F. and 60° F. during one whole year.² At Arequipa, considerably further south and at a lower elevation (7,650 feet), the climate seems to be more changeable than in the Jauja Valley. The *Himalayan high altitude resorts* are distinguished by their great annual rainfall, ranging from about 70 to 150 inches. Thus, Darjeeling (6,500 to 8,000 feet), in Bengal, which is reputed to be the coolest of the Indian hill-stations, has an annual rainfall of about 132 inches, and at the well-known summer resort of Simla the annual rainfall averages 76 inches. The tableland region, or *veldt*, of the interior of *South Africa* is 2,500 to 6,000 feet above sea-level, an immense elevated undulating dusty heath or prairie, with ranges of rocky hills and mountains. The climates of this region, like those of Swiss high altitude resorts, are characterised by low atmospheric pressure, great dryness, transparency and transcendence of the air, much sunshine and wide daily range of temperature, with comparative freedom from organic impurities in the air; but as disadvantages for invalids may be mentioned the great amount of dust, the winds, and the heat and absence of shade

¹ Vide Solly, *Medical Climatology*, Philadelphia, 1897, p. 253.

² See 'Climate of the Swiss Alps and of the Peruvian Andes Compared,' by Archibald Smith, *Dublin Quarterly Journal of Medical Science*, 1866, vol. xli. p. 351.

during summer. On the Central Karoo of Cape Colony the temperature during summer (that is, December, January, and February) is said to sometimes reach 110° F. in the shade, but the air is dry and the nights are cool. January, the hottest month, is said to have a mean maximum temperature of 87° F., whilst July, the coldest month, has a mean minimum temperature of 36° F. The mean daily range is about 27° F. The annual rainfall is only about 9 to 18 inches. Kimberley (4,042 feet) gets 3,258 hours of sunshine in the year—that is, as much as 74 per cent. of the possible amount.

Davos.—DAVOS-PLATZ (latitude $46^{\circ} 48'$ north), the best known winter mountain resort in Europe, lies in a valley of Canton Grisons, at an elevation of about 5,120 feet above sea-level. In 1862 Dr. A. Spengler (died 1901) drew attention to the advantages of the Davos climate by his communications to Dr. C. Meyer-Ahrens, the author of the well-known work on Swiss health resorts. Dr. F. Unger, a German medical man, suffering himself from pulmonary tuberculosis, arrived early in 1865. During the winter 1865 to 1866 there were two invalids only at Davos, but from that time, owing to Spengler and Unger, and, in England, Hermann Weber, the place became gradually more known. Twenty-two patients spent the winter 1866 to 1867 there, and after some years the number of visitors became so great as to constitute a danger from overcrowding. The drainage, however, was then thoroughly improved, and the place has maintained its reputation. The valley of Davos is about half a mile wide, and is watered by the Landwasser stream, which joins the Albula stream near Alveneu; the general direction of the Davos valley is from north-east to south-west, the health resort being situated on the north-west (more sunny) side of the valley, partly on the slope. The shelter from cold winds is very good. Dr. R. Billwiller, the Director of the Central Meteorological Institution of Switzerland, has kindly furnished us with the mean temperatures for the different months, derived from thirty years' observation (1864 to 1893). The mean monthly temperatures (transformed into degrees Fahrenheit), beginning at January, are the following: 18.8° , 22.8° , 26.4° , 35.8° , 44.2° , 50.2° , 53.8° , 52.4° , 47° , 37.6° , 29° , 21° . Mean annual temperature, 36.7° F. Dr. Billwiller gives us the mean annual relative humidity as 79.7 per cent.; and the mean relative humidities for the different months, beginning with January, as follows: 83.4, 80, 78, 78.1, 75.4, 77.8, 79.6, 80.7, 80.6, 78.9, 79.6, 83.2 per cent. The average amounts (in hours) of actual sunshine (1886-95) for the different months, beginning with January, are the following: 102.4, 115.8, 163.8, 173.7, 179.0, 171.9, 211.0,

200.9, 171.6, 131.1, 94.3, 89.0 ; for the year the total is 1,813½ hours, a rather higher figure than that of Hastings and the sunniest resorts of England.

The climate of Davos is best in winter, when the air is purer, the number of clear days greater, and the atmosphere stiller than in summer. In summer the heat during the day is often great and the dust is sometimes troublesome, whilst the mountain and valley winds may likewise be disagreeably felt. Davos is now connected by railway with the station of Landquart, on the line between Zürich and Chur (Coire). The 'open-air treatment' is thoroughly carried out at various sanatoria both for paying patients and for poor consumptives. Dr. Turban's sanatorium (on the slope, about 40 feet above the valley level) was built in 1887 and enlarged in 1894, the earliest establishment of its kind in the Swiss mountains. On the SCHATZALP, 6,120 feet above sea-level and about a thousand feet above the valley, a sanatorium was instituted (1900-1901) under the medical direction of Dr. L. Spengler, in a situation which gets about one hour more sunshine than Davos during the shortest days of winter. A funicular railway connects the Schatzalp with Davos. In the Davos district there are likewise foreign 'popular' sanatoria (German, Dutch, English) for the more or less gratuitous treatment of poor consumptives.

DAVOS-DÖRFLE, 1½ miles higher up the valley, has a climate similar to that of Davos-Platz ; as it is situated opposite to the entrance of the Dischma Valley, it is not quite so well sheltered from winds, but, on the other hand, gets slightly longer sunshine.

FRAUENKIRCH, in the same valley, 2½ miles below Davos, has a slightly lower elevation and not much accommodation for invalids. Opposite to it, in the Sertig Valley, is CLAVADEL. It lies on the sunny slope of the valley, at an elevation of 5,460 feet, and has greater advantages than Frauenkirch. There is here a private sanatorium for the treatment of pulmonary tuberculosis.

Wiesen is situated in the same valley (Landwasser), about 11 miles below Davos-Platz, at an altitude of about 4,760 feet above sea-level, on a terrace nearly 1,000 feet above the stream. The place is quieter and more picturesque than Davos, and gets rather more sunshine ; owing to its position, being fairly open towards the south, it can get five hours of sunshine even on the shortest winter days (10 A.M. to 3 P.M.). The ground is covered with snow somewhat later, and the snow melts somewhat earlier, than at Davos. It is sometimes used by patients for a stay before or after a season at Davos, but is not a winter resort proper.

The neighbouring KURHAUS MONSTEIN (5,250 feet), in the short branch valley of Monstein, opening higher up on the opposite side, may be mentioned as a summer resort. The little SPINABAD (4,820 feet), with a cold sulphur spring, is situated in the main valley about half-way between Davos and Wiesen.

Arosa, in a branch of the Schanfiggthal, is a more elevated winter and summer resort than Davos, from which it is separated by high mountains; to good walkers the two places are only about $4\frac{1}{2}$ hours distant by the Strela Pass. It consists of a number of hotels and villas, all enjoying considerable shelter from wind, the altitude of different portions varying from 5,700 to 6,090 feet above sea-level. The buildings of the higher portion, where there is sanatorium accommodation (6,090 feet) for consumptive patients, are best adapted for winter residence, because the sunshine lasts longer than in the lower portion (near the little lake), which is well suited for the summer months. Dr. Billwiller kindly tells us that the mean temperatures (from 10 years' observation, 1890 to 1899) are the following for the different months, commencing with January: 22.4° F., 24.1° , 27.7° , 34.2° , 41° , 47.8° , 51.4° , 51.4° , 46.8° , 39.6° , 33.1° , 25° . Mean annual temperature, 37° F. The mean relative humidity for the different months, beginning with January, is as follows: 60.3, 59.4, 62.8, 65.5, 67.8, 67.8, 68.4, 65.3, 66.5, 64.8, 59.9, 57.9. Mean annual relative humidity, 64 per cent. Dr. Billwiller also gives us the mean number of hours of actual sunshine (years 1890 to 1899) for the different months, beginning with January, as follows: 108.5, 127.7, 160.8, 159.2, 160.8, 163.8, 196.9, 214.1, 172.5, 142.4, 120.2, 99.4; total sunshine for the year, 1,826.2 hours. During the three winter months Arosa gets about $28\frac{1}{2}$ hours of actual sunshine more than Davos-Platz. Arosa has therefore a somewhat higher winter temperature, rather more sunshine, and a lower relative humidity, than Davos. It is, of course, a quieter place than Davos or St. Moritz. It can be reached by diligence in about 5 hours from the railway station of Chur.

St. Moritz.—ST. MORITZ-DORF, in the valley of the Upper Engadine (Canton Grisons), lies at an elevation 6,100 feet above sea-level, about 300 feet above the level of the valley. It is rather more windy and colder than Davos, and the ground becomes covered with snow somewhat earlier and begins to melt later. Dr. Billwiller has kindly furnished us with the following data, which, though referring to the neighbouring village of Sils, may to some extent be accepted as illustrating the climate of St. Moritz. Mean monthly temperatures (converted into degrees Fahrenheit), beginning with January: 17.4° , 20.6° , 24.6° ,

32°9', 41·2°, 48·2°, 52·2°, 50·7°, 45·3°, 36°, 27·1°, 19·6°. Mean annual temperature, 34·7° F. Mean relative humidity for the different months, commencing with January : 77·7, 76·4, 76, 73·9, 73·3, 71·8, 72·5, 75, 78·4, 78·4, 78·2, 77·7 per cent. Mean annual relative humidity, 75·8 per cent. The use of St. Moritz as a recognised winter resort dates from 1880-83, but Sir H. Weber advised patients to pass the winter there as long ago as 1867-70, and obtained encouraging results. The winter climate of St. Moritz is suited for a somewhat robust class of patients than that of Davos. The place is now especially suitable for the large class of persons free from tuberculosis and grave organic disease who, owing to overwork or other causes, require a holiday during winter in a sunny, very bracing resort, where there are good opportunities for skating, tobogganing, and the open-air sports of the season, which have been for many years successfully cultivated by English visitors to the Alps, especially at St. Moritz.

ST. MORITZ-BAD (latitude 46° 30' north) is situated at the ordinary level of the valley, about 300 feet lower than the Kulm (upper part of the village) of St. Moritz, from which it is about 1½ miles distant. On one side of the spa is the lake of St. Moritz, and on the other side the lake of Campfer. The chalybeate springs, for which St. Moritz-Bad has long been known, are used in the same class of cases as those of Spa, Schwalbach, Pyrmont, &c., but are rather weaker in the proportion of bicarbonate of iron they contain. Visitors taking the waters have the alternative of residing at St. Moritz-Dorf, which is on the whole more bracing than the spa itself, and is connected to it by an electric tramway; they may likewise stay at the neighbouring village of Campfer. The springs are not kept open during winter; the spa season is from the middle of June to the middle of September. In the case of feeble patients, and those with excitable vasomotor system, it is advisable to rest some time preliminarily at an intermediate station of somewhat lower altitude, such as Churwalden, Parpan, Savognin (German, Schweiningen), or Bergün. St. Moritz is now connected with Thusis and Chur (Coire) by a railway via the Albula Pass, Tiefenkasten, and the magnificent scenery of the so-called Schyn Pass.

Leysin, 4,760 feet above sea-level, the modern summer and winter resort near Aigle (in Canton Vaud), is situated about 600 feet above the village of Leysin, on the south-western slope of the Tour d'Ai mountain chain. Its position, open towards the south, gives Leysin plenty of sunshine and a beautiful view across Aigle and the Rhone Valley, towards the peak of the Dent-du-Midi. It is sheltered from northerly and north-easterly winds by the Tour d'Ai behind it, and has good paths and pine woods in the

neighbourhood, where exercise can be taken. According to De la Harpe, for 100 hours of actual sunshine at Davos during the winter months, there are 108 at Leysin village. The maximum possible daily sunshine for December is $7\frac{1}{2}$ hours, and for January 20 minutes more. Mean temperature for February (the coldest month), 27.8° F. Leysin can be reached in one hour from Aigle by the electric rack-and-pinion railway, and in 24 hours from London. The modern open-air treatment for pulmonary tuberculosis &c. is carried out at the various sanatoria of Leysin, which include, besides three 'hotel-sanatoria,' a 'sanatorium populaire' for patients of limited means, a sanatorium for tuberculous and weakly children, and a surgical sanatorium.

Montana (Canton Valais).—This summer and winter station is situated on the heights to the north of the Rhone Valley, above the village of Montana, at an altitude of about 5,010 feet above sea-level. It lies in a kind of natural park, with beautiful pines and lawn-like grassy slopes, about 2 hours distant from the railway station of Sierre, with which it is connected by a good carriage road, completed in 1898. There is rather too much water in the shape of small lakes in the neighbourhood. The big sanatorium for consumption at Montana is at present closed.

Les Avants (Canton Vaud), above Montreux, stands at an elevation of 3,500 feet, in a broad semicircle of mountains, sheltered on all sides except the south by the surrounding heights. Its position, free towards the south, is very sunny, and the time during which the ground is covered with snow is shorter than at Davos; the snow has usually disappeared in the beginning of March. Les Avants is kept open all the year round, and is suitable in cases where a milder climate and somewhat lower elevation is needed than Arosa, St. Moritz, Davos, &c. It is connected by electric railway with Montreux.

There are a few other resorts in the mountains of Switzerland, such as Samaden in the Engadine, Château-d'Oex, and Grindelwald, used to some extent during winter as well as during summer; but these will be referred to amongst the merely summer resorts in the Swiss mountains, which we shall now consider. Attempts to make winter resorts of such places as the Maloja, Andermatt, and St. Beatenberg have not been successful.

SWISS SUMMER RESORTS OF HIGH ALTITUDE—THE ENGADINE

The summer season in the high mountain resorts is a short one, varying at the different localities from three to five months. There are hotels (such as some in the Upper Engadine) which are only open from the middle of June to the middle of September,

whilst there are others (such as the Belalp Hotel above the Rhone Valley) which remain open during the five months June to October; most of them are open for about four months.

We must here shortly mention some of the features of the summer climate of Swiss mountain resorts, such as those of the Upper Engadine, Davos, and Arosa.

Though the temperature during the summer months may reach 70° to 80° F. in the shade, the highest mean monthly temperature is only about 54° F., and the temperature sometimes falls 35° or 40° F. within a day. Though the absolute annual range of temperature is about 80° F. to 95° F., the difference between the mean temperatures for the hottest and coldest months of the year is only about 25° to 35° F. The mean daily range of temperature at all seasons of the year can be put down at about 12° to 15° F. The mean temperature for the three summer months is about 50° to 53° F., and the number of rainy days (Davos) during the same period is about 35. There is more wind and more dust in summer than in winter.

The Engadine.—The localities in the **Upper Engadine** are the most popular resorts of high altitude in Europe and probably in the world. In addition to excellent hotels, beautiful scenery, and in some cases, as at Pontresina, the proximity of glaciers, they have likewise the advantage of good carriage roads which allow of drives in several directions. In the latter respect they can scarcely be rivalled by other mountain resorts. The Engadine Valley, or Swiss portion of the Valley of the Inn, stretches from the Maloja Pass at the south-west to the Austrian frontier at the north-east. The portion of the valley above Punt-Ota (between Zuz and Zernez) is called the Upper Engadine, to distinguish it from the Lower Engadine, which has a somewhat lower elevation and a rather less bracing climate.

The MALOJA or MALOGGIA (5,960 feet) is the lowest pass between Switzerland and Italy. At the summit of the pass, just above the southern extremity of the Lake of Sils, stands the fine Hôtel Kursaal, which at first was kept open during the winter as well as during the summer, but is now used merely as a summer resort, from the middle of June to the end of September. The views from the Maloja in both directions are very fine. The descent on the Val Bregaglia side of the pass (towards Chiavenna) is precipitous, and forms a contrast to the Engadine side.

SILS MARIA (5,895 feet) stands at the north-eastern end of the Lake of Sils, at the entrance of the Fex Valley. The accommodation is comfortable, and there are shady walks in the neighbourhood. Sils Maria has the advantage of being half a mile

distant from the dusty road between Maloja and St. Moritz, which passes by SILS BREGAGLIA. We have given some meteorological data concerning Sils in speaking of St. Moritz.

SILVAPLANA (5,958 feet) is a quiet, and, in summer, rather dusty, place between the Lakes of Silvaplana and Campfer. CAMPFER (6,000 feet), near the northern end of the small lake of that name, is only about $1\frac{1}{2}$ miles distant from St. Moritz-Bad, and persons drinking the waters of St. Moritz, if they prefer a quieter place, can reside at Campfer.

The village of ST. MORITZ has been already considered under winter resorts, and for convenience we described the baths of St. Moritz in the same place.

CELENINA (5,650 feet), between St. Moritz and Samaden, has accommodation for the less fastidious.

SAMADEN (5,670 feet), 3 miles from the village of St. Moritz, is both a summer and winter resort, and has a winter climate very similar to that of St. Moritz. It is the chief village of the Engadine, and the accommodation is satisfactory.

Six miles below Samaden is ZUZ (5,548 feet), a pleasant village with good accommodation. The mean temperature for July reaches 57.4° F. at this place. The shady walks are rather too distant, none less than twenty minutes.

PONTRESINA (5,915 feet), about $3\frac{1}{2}$ miles to the south-east of Samaden, lies in a branch valley leading from the Upper Engadine over the Bernina Pass towards Italy. The village, with its numerous hotels, extends for half a mile or more along the right (sunny) side of the valley, opposite the opening of another valley leading to the Roseg Glacier. Mean July temperature, 51.6° F. The proximity of large glaciers, the shady walks in the neighbourhood, and the excellent accommodation are great advantages for persons needing rest from mental work in a bracing sunny climate, with facilities for walking and climbing exercise. Pontresina is, however, the most fashionable summer resort of the Engadine, and is much more visited by healthy persons (for the great beauty of the scenery, the mountaineering, &c.) than by invalids.

In the **Lower Engadine** are the well-known springs of TARASP, with the neighbouring health resorts of SCHULS and VULPERA. The Kurhaus of Tarasp (3,890 feet) is situated in a deep part of the valley, on the northern bank of the Inn, and though more sheltered from winds, gets less sun than the more elevated and open villages of Schuls (3,970 feet) and Vulpera (4,180 feet). The spa is best known for its sulphated-alkaline mineral waters, but some of the springs may be classed in the gaseous chalybeate group. The VAL SINISTRA water, in the

neighbourhood, contains a certain amount of arsenic in addition to bicarbonate of iron. In Part III of this volume we shall have occasion to point out many conditions in which mineral water treatment at Tarasp is suitable. The climate of this neighbourhood is milder than that of the Upper Engadine, as is shown by fruit ripening at Schuls. The mean temperature for the three summer months at Schuls is 59° F., and the number of rainy days 25. The mean summer temperature at Tarasp is apparently about 1° F. lower than at Schuls. The good accommodation, the fine walks, and the beauty of the scenery render the neighbourhood very attractive for summer residence. Persons taking the waters at Tarasp may reside at either of the three localities. FETTAN, on the north side of the valley, 1½ hours by carriage from Schuls, has a considerably more elevated position (5,405 feet), and beautiful views towards the south. The accommodation, however, is as yet only moderate. Mean temperature for July, 54·5° F.

OTHER SWISS SUMMER RESORTS OF HIGH ALTITUDE

We will first mention other resorts in the Canton of Grisons, and then proceed to those in other parts of Switzerland.

KLOSTERS, in the broad Praetigau Valley, is on the line of railway to Davos. It consists of different portions, the highest of which is KLOSTERS-DÖRFLI, 4,190 feet above sea-level. Mean temperature for the three summer months about 53° F.

BAD FIDERIS (3,580-feet), lower down the Praetigau Valley, has weak gaseous chalybeate waters (see Part II, Chapter XXIII).

The village of LANGWIES (4,285 feet), the chief place of the Schanfiggthal, is used as a summer resort; it stands on the road from Chur to Arosa, and at the foot of the Strela Pass to Davos.

On the Bernina Pass, between Le Prèze and Pontresina, is the BERNINA HOSPICE HOTEL (7,575 feet), one of the highest hotels in Switzerland, but only rarely used for a prolonged stay as a health resort.

The following places are on the Julier route, between the Upper Engadine and Chur: MOLINS (German, Mühlen), alt. 4,790 feet; SAVOGNIN (German, Schweiningen), alt. 4,060 feet; KURHAUS LENZER-HEIDE, alt. 4,775 feet; PARPAN, alt. 4,940 feet; CHURWALDEN, alt. 4,120 feet.

BERGÜN (4,475 feet) is situated in the Albula Valley, close above the romantic gorge termed the Bergünner Stein.

SOGLIO (3,570 feet), in the Val Bregaglia, near the Italian frontier, can be used as a quiet summer resort.

SPLÜGEN (4,760 feet) lies in an open valley at the northern foot of the Splügen Pass.

SAN BERNARDINO (5,320 feet), on the south side of the pass of that name, between Splügen and Bellinzona, has gaseous chalybeate waters and satisfactory accommodation.

We shall now mention the summer resorts which we should pass were we to travel from Chur up the Vorder-Rhein Valley, and then, crossing the Oberalp and Furka Passes, proceed down the Rhone Valley to the Lake of Geneva.

The FLIMSER WALDHÄUSER, with the KURANSTALT WALDHAUS FLIMS (3,620 feet), near the little town of Flims, on the northern slope of the Vorder-Rhein Valley, are celebrated for their beautiful pine and beech woods. A new establishment for hydrotherapy and electrotherapy is under the care of Dr. von Planta. On hot summer days the more robust visitors can bathe in the little Cauma lake (3,200 feet), when the temperature of the water may reach about 70° F.

VALS-AM-PLATZ (4,090 feet), in the Valser Thal, to the south of the main road from Chur to the Oberalp, has the subthermal (77° F.) sulphate of calcium St. Peter's spring and fair accommodation.

DISENTIS has excellent accommodation and a rather mild climate for the altitude (3,770 feet).

ANDERMATT (4,738 feet), on the western side of the Oberalp Pass and on the northern side of the St. Gothard Pass, 4 miles from the Göschenen station of the St. Gothard Railway, is used as a summer resort. It is not well sheltered from winds, and attempts to make the place a winter as well as summer resort have not succeeded. The mean winter temperature (for the five months November to March) is 21.7° F., therefore lower than that of Arosa and Davos, though both the latter places are more elevated.

HOSPENTHAL (4,800 feet), 1½ miles south-west of Andermatt, has good summer accommodation.

We may here mention the HÔTEL PIORA (6,100 feet), in the Val Piora, sheltered from north winds. The mean July temperature, according to de la Harpe, is about 56.3° F. It can be reached from the railway station of Airolo in about 2½ hours.

On the western side of the Furka Pass is the Rhone Valley, in which and its branches a number of high altitude resorts are situated. Amongst them the following may be mentioned:

The BELVÉDÈRE HOTEL (7,220 feet) is situated at scarcely four minutes' walk from the Rhone Glacier. The RHONE GLACIER HOTEL (5,770 feet) is further from the glacier, at the junction of the Furka and Grimsel Passes.

ZERMATT (5,315 feet) lies in a valley amidst high glacier-covered mountains, commanding magnificent views of the Matterhorn and other peaks. The mean temperature for June, the

hottest month, is 52° F., and for the three summer months 51·2° F. It is a great mountaineering centre, and hence rather noisy for persons needing quiet. The railway journey from Visp (Viège), in the Rhone Valley, takes about 2½ hours. Above Zermatt are the still higher hotels, the RIFFELALP (7,305 feet), the RIFFELHAUS (8,430 feet), the SCHWARZSEE (LAC NOIR) HOTEL (8,490 feet), and the GORNERGRAT HOTEL (10,260 feet); the last three are quite unsuitable for delicate invalids.

The HÔTEL BELALP (7,155 feet), near the Aletsch Glacier, is a favourite summer resort of the English.

Other resorts of high altitude in the Rhone Valley and its branches, between Visp and the Furka Pass, are the RIEDER-FURKA (6,820 feet), the RIEDER ALP (6,315 feet), the EGGISHORN HOTEL (7,190 feet), BINN (4,720 feet), BERISAL (5,000 feet), and SAAS-FÉE (5,900 feet).

To the south of the Rhone Valley, between Visp and Martigny, are MAYENS DE SION; EVOLENA (4,520 feet), in the Val d'Hérens, 6 hours from the railway station of Sion; AROLLA (6,570 feet), a very bracing resort, in a branch of the Val d'Hérens, 3½ hours from Evolena; the HÔTEL BELLA TOLA and HÔTEL MONT-CERVIN, near St. Luc; CHANDOLIN (6,340 feet), above St. Luc; the HÔTEL WEISSHORN (7,690 feet), with too little shade, above Vissoye; ZINAL (5,500 feet), near the southern end of the Val d'Anniviers; and the LAC DE CHAMPEX (4,810 feet), near Orsières. To the south-west of the Rhone Valley, between Martigny and the Lake of Geneva, above Vernayaz, is FINHAUT (4,060 feet), and, nearer to the Lake of Geneva, at an altitude of 4,300 feet, in the Val de Morgins, a branch of the Val d'Iliez, is MORGINS-LES-BAINS, with chalybeate waters.

In the valleys and on the heights to the north of the Rhone Valley, between Visp and the Lake of Geneva, are Loèche-les-Bains and several places to be reached from Bex and Aigle, which we must now consider. Montana, above Sierre, and Leysin, above Aigle, have already been referred to amongst winter resorts. Above Bex we may mention GRYON, a village situated on a slope, at an altitude of 3,632 feet, commanding a magnificent view of Bex in the valley below it, and of the Dent-du-Midi on the opposite side of the Rhone; it has perhaps too little shade. LES PLANS-DE-FRENIÈRE is a neighbouring village at a slightly lower elevation, close to shady woods. VILLARS-SUR-OLLON and CHESIÈRES are situated close together on sunny open slopes, about 4½ hours by diligence from the railway station of Aigle; Villars (4,170 feet) is about 200 feet more elevated than Chesières, from which it is about 20 minutes distant. Villars and Gryon are now connected by a mountain railway with Bex. Other

summer resorts to be reached from Aigle are the *HÔTEL DES DIABLERETS* (ORMONT-DESSUS); *LA COMBALLAZ* and *LE SEPEY* (ORMONT-DESSOUS); and *CHÂTEAU D'OEX*. The latter place, much resorted to by the English, is situated in the middle of the valley of the Sarine, at an elevation of under 3,500 feet. It is likewise, in spite of its comparatively low elevation, to some extent used as a winter resort. Mean temperature for the three summer months (June to August), 56.3° F.; for the five winter months (November to March), 34° F. Mean annual rainfall, $46\frac{1}{2}$ inches.

LOÈCHE-LES-BAINS (Leukerbad) is situated in Canton Valais, at an altitude of 4,600 feet, on the southern side of the Gemmi Pass, about $3\frac{1}{2}$ hours by carriage from the railway station of Loèche-Souste, in the Rhone Valley. The expanded valley-head, in which the baths of Loèche lie, is surrounded by precipitous mountains, except on the south and north-east, and to some extent, at least more than most Alpine valley-heads, is analogous to the famous 'Cirque de Gavarnie' in the Pyrenees, though it is not so regular in shape as the vast amphitheatre of Gavarnie is. The shelter from cold winds is fairly good. The midday in summer may be very hot, the heat being increased by reflection from the rocks; but, owing to the surrounding heights, the sun rises late and sets early, and on the longest days of the year can shine only between 7 A.M. and 5 P.M. The season lasts from June to September, and for these months Dr. de Werra calculates the mean temperature at 1 P.M. as about 60° F., whilst the mean temperatures at 7 A.M. and 9 P.M. are about 50° F. The mean relative humidity for the season is about 68 per cent. The rainfall for the season is about $16\frac{1}{2}$ inches, and for the whole year about 30 inches. Loèche-les-Bains has thermal waters (containing a moderate amount of sulphate of calcium) somewhat resembling those of Bath, in England; they are chiefly employed for prolonged tepid baths in chronic cutaneous affections. The local effect of these prolonged baths on the skin is, as Dr. de la Harpe points out, an irritative or stimulant one; they are serviceable in very chronic cases of eczema and psoriasis, which are not spreading and not accompanied by much itching.

In the neighbourhood of Loèche-les-Bains is the *TORRENTALP HOTEL*, in an open position, with fine views, at an elevation of 8,000 feet above sea-level; at this elevation, of course, no shady trees can be expected.

We will now proceed to high altitude resorts in other parts of Switzerland, mentioning first of all those in the **Bernese Oberland** and other parts of the Canton of Bern.

GRINDELWALD (3,460 feet) is beautifully situated to the north of the great Bernese mountains, and is not far from two large

glaciers (the Upper and the Lower Grindelwald Glaciers), which are great attractions for tourists during the summer season. It is well sheltered from the north, but the south wind (Foehn) is sometimes violent, especially during spring and autumn. Grindelwald is used as a winter resort as well as a summer resort. It is frequently visited during winter by healthy persons for the tobogganing, skating, &c. Mean temperature for the three summer months, about 64° F.; for the three winter months, about 31° F. Besides the hotels in the village there is one in a much higher situation above it, open during the summer season only.

MURREN (5,350 feet), a much frequented summer resort, has a magnificent view towards the mountains of the Oberland.

WENGEN, the HÔTEL JUNGFRAU on the WENGERNALP, the HÔTEL BELLEVUE on the LITTLE SCHEIDEGG, ISENFLUH (3,600 feet), above Zweilütschinen, ROSENLAUI, ENGSTLENALP, and the AXALP, above Giessbach, are other summer resorts of the Oberland.

The BATHS OF LENK (3,630 feet), near the northern end of the Upper Simmenthal, commanding a fine view of the rocky ridges and glaciers of the Wildstrubel Mountain, possess strong sulphur waters.

ADELBODEN has a sunny position on the side of the beautiful valley of Adelboden (or Engstlichenthal). It is completely sheltered from the north by the slope on which it lies, and has an elevation of 4,450 feet above sea-level. In the Upper Diemtighthal is the recently erected Kurhaus GRIMMI-ALP, 4,130 feet above sea-level.

ST. BEATENBERG (3,770 feet) is a beautifully situated summer resort to the north of the Lake of Thun, well sheltered on the north and north-east. Attempts to make a winter as well as a summer resort of the place have not been successful. Mean temperature for the three summer months, 56.5° F.; for the three winter months, 30.4° F. It is reached by a cable railway from a station on the lake.

GURNIGEL (3,780 feet) has an open situation on the northern slope of the Gurnigelberg, adjoining an extensive pine forest with numerous sheltered paths. The sulphurous waters have a special reputation in disorders of the digestive organs. Mean temperature of the air for July, the hottest month of the year, 60.6° F.; daily range, 13.3° F. The relative humidity is said to be rather high, on account of the forest.

Amongst high altitude summer resorts in other parts of Switzerland are the HÔTEL ALPENCLUB (4,790 feet), above Amsteg, in the picturesque MADERANER THAL (Canton Uri); the sulphur baths of SCHIMBERG (4,670 feet), in Canton Lucern; and the

well-known hotels on the RIGI, the PILATUS, and the STANSERHORN; the hotels on these three mountains, with the exception of the Rigi-Scheidegg (5,460 feet), are too much frequented by tourists to be suitable for persons requiring rest and quiet. On the Rigi is the 'Rigi Colony' sanatorium (5,400 feet) for pulmonary tuberculosis. CHAUMONT (3,845 feet), above Neuchâtel, and KURHAUS WEISSENSTEIN (4,220 feet), above Solothurn (Soleure), in the Swiss Jura Mountains, possess, owing to their open situations, more bracing climates than would correspond to the same elevations in the Alpine ranges. The Weissenstein, like the Rigi, &c., is frequented by passing tourists for the view.

SWISS RESORTS OF LOW AND MODERATE ELEVATION (BELOW 3,500 FEET), INCLUDING THOSE OF THE SWISS LAKES

In Chapters I and II we have alluded to the influence of the proximity of large inland lakes, and we shall now speak of localities in the neighbourhood of the **Lake of Geneva**. This great lake lies just south of latitude 46° 30' north, at an elevation of 1,230 feet above sea-level, and has a mean depth of 500 feet. The temperature¹ of the surface water varies from about 45° F. in winter to 80° or even 85° F. in summer, and the lake is never entirely frozen over. The western part is bordered by much nearly level ground, but the eastern part is surrounded by mountains which are closest to the shore on the southern or French side of the lake. The writings of J. J. Rousseau and Byron helped in making the district from Vevey to Chillon well known.

Montreux (latitude 46° 26' north), on the north-eastern shore of the Lake of Geneva, is the best known health resort of the Swiss lakes. It is mostly taken to include the whole district from Clarens to the picturesque Castle of Chillon (CLARENS, VERNEX, MONTREUX, TERRITET, and VEYTAUX). This strip of land, situated between the shore of the lake on the south and the sheltering mountain wall on the north, has been termed the 'Riviera of the Lake of Geneva;' it is famous as a locality for the grape cure in the autumn, as well as for its climatic features. The chief seasons are autumn and spring, but there are numerous visitors at all times of the year. Dr. Billwiller, Director of the Central Meteorological Office of Switzerland, has kindly furnished us with the mean temperatures and relative humidities of Montreux: Mean annual temperature, 50·2° F. Mean monthly temperatures, beginning with January: 34°, 36·9°, 40·6°, 50°, 58°,

¹ See also the monthly temperatures of the lake according to Professor F. A. Forel &c. in C. Buhner's *Le Climat de Montreux*, 1901.

65°9', 66°8', 65°, 59°6', 50°4', 42°1', 35°4'. Mean relative humidity for the different months, commencing with January: 77·3 per cent., 73·4, 67·1, 65·7, 66·6, 66·8, 66·6, 67·9, 75·6, 76·9, 76·9, 77·8 (average for the year, 75·2 per cent.). Mists are, on the whole, relatively rare. The mean annual rainfall is 46 inches, and there are about 140 rainy days. The climate is often compared to that of Meran, in Tirol, and the mean winter temperatures of the two places are nearly the same. The amount of actual sunshine at Montreux is not great in comparison to that at many health resorts. The mean duration in hours for the different months has been kindly furnished by Dr. Billwiller from the official observations for the years 1893 to 1899. Beginning with January, the figures are the following: 66·9, 95·3, 136·4, 170·5, 174·8, 191·4, 222·4, 234·5, 163·0, 123·2, 72·5, 56·3. If we can trust to figures obtained from such a limited period of observation, the average yearly amount of sunshine at Montreux is only 1,707 hours—that is, about 54 hours less than at Hastings on the south coast of England; whilst during the three winter months Montreux has about 88½ hours less sunshine than Davos-Platz, and about 176½ less than Lugano. At Montreux there is not the marked diurnal variation of temperature which is so striking a characteristic of the Western Riviera climate, and excitable patients who suffer from sleeplessness &c. on the Riviera often do well at Montreux. The best season at Montreux is autumn, whilst during spring falls of snow on the neighbouring slopes occasionally cause sudden changes in the temperature of the air. The mountains to the north of Montreux afford great protection from cold winds. The 'bise,' or north-east wind, which is very troublesome on the shores of the lake from Geneva to Lausanne, is hardly felt at Montreux. In a general way the protection afforded by the mountain wall may be said to increase in a direction eastwards along the coast from Vevey. Territet and Veytaux are the most protected spots, but as a consequence of their position get slightly less sunshine. Thus, during the shortest days of winter, whilst Clarens can get six hours of sunshine, Veytaux can only get five (about 10.30 A.M. to 3.30 P.M.).

The grape cure in Montreux and the neighbourhood begins about the end of September and lasts about a month. The grapes are smaller, have thinner skins, and contain more sugar than those of Meran. Montreux is likewise an excellent locality for courses of milk and whey.

Above Montreux are several localities situated on the slopes and mountains at various higher elevations. Amongst these are CHARNEX, or CHERNEX (1,890 feet), 1½ miles above Clarens; LES PLANCHES (1,480 feet), above Montreux; MONT-FLEURI

(1,970 feet) and VAL-MONT (2,200 feet, a sanatorium for dietetic treatment &c.), above Territet; and higher up still Glion, Caux, and Les Avants. LES AVANTS (3,500 feet) has already been described amongst winter resorts. GLION (2,250 feet) has a sunny situation on a terrace about 1,000 feet above the lake; it commands beautiful views, and is reached by a funicular railway in about nine minutes. The hotels (Grand and Palace) of CAUX (3,610 feet), which, like Les Avants, are kept open all the year round, have a more open and slightly more elevated but less sheltered position than Les Avants. They are reached by the rack-and-pinion railway between Glion and the ROCHERS DE NAYE, where there is likewise a hotel (kept open during the summer months), at an elevation of about 6,470 feet.

There is therefore a great choice of altitudes at which patients and visitors may reside in the neighbourhood of Montreux. The hotel or dwelling must be selected according to the nature of the case and the season of the year. During hot weather the scarcity of shade may be felt in this district, but there are some woods, as near Veytaux and in the shady Gorge du Chaudron between Glion and the lake.

VEVEY, $3\frac{1}{2}$ miles westward of Clarens, has a beautiful position on the lake, but is less sheltered from the north and north-east than Montreux, and its temperature is more variable. The 'bise' or north-east wind is, however, not nearly so much felt at Vevey as at Lausanne and Geneva. Vevey is at its best in autumn, and is a good place for grape cures and milk cures. Climates of higher altitude may be rapidly reached by the recently opened funicular railway from Vevey to MONT-PÉLERIN (3,550 feet). The whole shore from Vevey to the Castle of Chillon is connected by an admirable electric tram service.

LAUSANNE has a hilly situation above the northern part of the curve of the northern shore of the Lake of Geneva. The altitude of different portions varies from 1,500 at the railway station, to 1,735 feet at the commanding terrace on which the Cathedral stands. The city is much exposed to winds from the south-west and north and north-east, and has a somewhat colder and less equable climate than Montreux. Mean annual temperature (Hirzel, quoted by de la Harpe), $49\cdot3^{\circ}$ F.; mean January temperature, $32\cdot5^{\circ}$ F.; annual rainfall, nearly 41 inches; 151 rainy days. There are good villas and houses in the newer quarters, and the facilities for the education of children and the moderate expense of living at Lausanne have attracted many English as permanent residents.

OUCHY (1,230 feet), the port of Lausanne, with which it is connected by a cable railway, is more sheltered from the north. The Beau Rivage and other hotels border the lake.

We may here mention the French spa, EVIAN-LES-BAINS, situated opposite to Lausanne, on the southern shore of the Lake of Geneva. Its weakly mineralised waters and baths are much resorted to by the French in affections of the urinary system. Owing to its position on the lake to the north of the mountains, the summer is less hot than at Lausanne and Montreux. The bathing season is from June to the commencement of October. THONON, with similar waters, is situated 6 miles to the west of Evian, on a cliff about 130 feet above the lake.

GENEVA (latitude $46^{\circ} 12'$ north), though not strictly speaking a health resort, is much visited by invalids and others on their way to and from various health resorts. It is situated (altitude 1,240 feet) on the Rhone, at the south-western extremity of the Lake of Geneva, within sight of the high mountains of the Mont Blanc group. Its beautiful position, excellent accommodation, and the museums and attractions of a large town serve to attract many visitors, whilst the facilities for education offered by its schools and university induce some families to choose Geneva as a place of permanent residence. The mean annual temperature (48.6° F.) is slightly lower than that of Lausanne. Mean relative humidity, 82 per cent. Annual rainfall, 33.3 inches. The cold north-east winds are often disagreeably felt.

CHAMPEL-LES-BAINS, or CHAMPEL-SUR-ARVE, on a hill (1,360 feet above sea-level), in the south-eastern suburb of Geneva,¹ is an excellent place for hydrotherapeutic treatment; it derives its water from the river Arve, which flows past the establishment.

We may here mention another well-known hydrotherapeutic establishment, easily reached from Geneva. It is that of DIVONNE-LES-BAINS (1,540 feet), situated in French territory, at the foot of the Jura Mountains, half an hour distant by carriage from the Swiss railway station of Coppet.

To the north of Geneva, ST. CERQUES (3,420 feet) has a very bracing position in the Jura Mountains, high above the Lake of Geneva, about $6\frac{1}{4}$ miles from the railway station of Nyon. To the north-east, further away than St. Cerques, is GIMEL (2,400 feet), a popular summer resort of the inhabitants of Geneva, with chalybeate waters and beautiful walks in the neighbouring woods; it is 5 miles distant from Aubonne.

Here we may likewise mention some French climatic resorts to the south-east and east of Geneva, MORNEX (1,630 feet) and MONNETIER (2,330 feet), beautifully situated on the Salève Mountain, and the hotels (of higher elevation) on the Voirons

¹ It was on the hill of Champel that Michael Servetus, a forerunner of Harvey in regard to the circulation of the blood, was burnt to death as a heretic in 1553.

range, all of them easily reached from Geneva (the resorts of the Voirons belong really to our group of high altitude, that is, above 3,500 feet).

We will now pass to some localities in the **Rhone Valley** and its branches above the Lake of Geneva.

AIGLE-LES-BAINS (1,770 feet) has comfortable hotel accommodation at the entrance of the Valley of Les Ormonts, and has good arrangements for hydrotherapeutic treatment. From Aigle the higher resorts, Leysin, Chesières, and Villars, which have been previously mentioned, are reached.

CHAMPÉRY (3,450 feet), in the centre of the Val d'Illicz, is a popular summer resort, reached in 3¼ hours by carriage from the railway station of Monthey; there are many interesting mountain excursions to be made by the more robust visitors.

BEX (1,430 feet) has a sheltered position on the right side of the valley, opposite the Dent-du-Midi. It is well provided with strong brine waters used for baths and douches. The *Hôtel des Salines* has a somewhat more elevated position (1,520 feet), and is pleasantly situated in a park, about half a mile to the north-east of the village. The best months for Bex are May and June, and from the end of August to the end of September. July is hot (mean temperature, 67° F.). During the shortest days of winter the sun shines only three hours (11 A.M. to 2 P.M.). Bex is an excellent place for a grape cure. It is connected by a mountain railway with the higher resorts of Gryon and Villars, and by diligence with Les Plans-de-Frenière, all three places already mentioned.

LAVEY-LES-BAINS (1,350 feet), with sulphur waters, is situated between the right bank of the Rhone and the Dent-de-Morcles, about 1¼ miles from the railway station of Saint-Maurice.

To the south-west of the Rhone Valley, above Vernayaz, are the resorts of **SALVAN** (3,030 feet), **MARECOTTE** (3,280 feet), and **TRIQUENT** (3,260 feet). Finhaut (4,060 feet) has been included amongst the places of high altitude previously mentioned.

SION (1,710 feet), further up the valley, has the relatively high mean annual temperature of 51° F., and the summer is very hot (mean, 66·7° F.). In autumn (mean, 50·9° F.) Sion can be visited for a grape cure. *

SIERRE, pleasantly situated in the valley (1,765 feet above sea-level), has a warm dry climate. The *Hôtel Bellevue* is used as a winter resort by the English. Montana, above Sierre, has been mentioned amongst high altitude stations. At **CLAIRMONT-SUR-SIERRE** (4,850 feet) is the Genevese popular sanatorium for consumptives.

*Still higher up in the Rhone Valley, **VISP** (French, Viège), where the railway to Zermatt branches off, and **BRIG** (French Brique), the present railway terminus, have rather higher elevations (about 2,150 and 2,250 feet) than Sierre and Sion. Accommodation fair.

ACQUAROSSA (1,150 feet), in Canton Ticino, is situated amidst high mountains in the Val Blenio, about $8\frac{1}{2}$ miles to the north of the St. Gothard railway station Biasca; the mineral waters are subthermal chalybeate, containing small quantities of arsenic.

In the different parts of Canton Grisons, besides the high altitude resorts which we have already mentioned, there are a number of places at various elevations below 3,500 feet, some of them well suited as intermediate stations on the way to and from high altitude resorts, and for a stay during autumn and winter. Amongst them we may mention: the baths of **LE PRESE** (3,160 feet), in the Val di Poschiavo; **PROMONTIGNO** (2,685 feet), in the Val Bregaglia; **ILANZ** (2,350 feet), in the Vorder-Rheinthal; the baths of **PEIDEN** (2,700 feet), in the Lugnetz Valley, $3\frac{1}{2}$ miles to the south of Ilanz; **TIEFENKASTEN** or **TIEFENKASTELL** (2,790 feet), and the neighbouring baths of **ALVANEU** or **ALVENEU** (3,150 feet), on the Albula route; **THISIS** (2,450 feet), near the famous scenery of the Via Mala and the Schyn Pass; **ANDEER** (3,200 feet), in the Schamser Thal, about 3 hours by carriage from the railway station of Thisis, with the neighbouring baths of **PIGNIEU**; **ROTHENBRUNNEN**, with weak iodine and chalybeate waters and a bath establishment, in the valley of the Hinter-Rhein, about half-way on the railway between Thisis and Reichenau (the waters have an old reputation in Switzerland for the treatment of scrofulous and backward children); the baths of **PASSUGG** in the Rabiusa Valley, one hour distant from Chur; and **SEEWIS**. The last-named place is pleasantly situated on a terrace of the northern slope of the Praetigau Valley, at an elevation of about 3,000 feet above sea-level. It is open from the commencement of April to the end of September, and is a useful spring and autumn resort, and a good place for milk and whey cures.

Here we must mention **Ragatz** (1,700 feet), in Canton St. Gall, as it is quite close to Canton Grisons. This well-known health resort is situated on the south-western side of the Rhine Valley, at the entrance of the Tamina Gorge, 3 miles from the baths of Pfäfers, from which it receives its thermal waters. Ragatz is an excellent climatic station from the middle of May to the end of June, and from the second week in August to the middle of September. Mean temperature for May, 53.8° F.; for July, 64.2° ; for September, 56.7° . The indications for Ragatz, in

addition to those for its climate, are those for simple thermal baths (89°-93° F.), in conjunction with Swedish gymnastics, massage, electricity, or ordinary hydrotherapeutic treatment, when deemed advisable. PFAEFERS itself, shut up in the deep Tamina Gorge, has naturally a cooler and moister climate, with less sunshine, so that the establishment is kept open for a much shorter period. Ragatz has a station on the railway between Chur and Sargans. About 1,000 feet above Ragatz, and connected with it by a funicular railway, is the WARTENSTEIN HOTEL. Accommodation at a higher elevation is likewise to be had at the village of VALENS (3,020 feet), not far from Ragatz.

In **Canton Bern** there are several places to be mentioned. **BERN** itself (1,765 feet), the seat of the Swiss Government, has a changeable climate. Mean annual temperature, 46·4° F. Mean January temperature, 27·9° F. Annual rainfall, 39·6 inches. The quaintness of the old portion of the city, and the beautiful views from Bern and its neighbourhood towards the Oberland, cause the town to be frequently visited by persons on their way to and from health resorts in Switzerland.

Around the **Lake of Thun** (about 1,840 feet above sea-level) and the neighbouring **Lake of Brienz** (about 1,860 feet) a number of health resorts are grouped. **INTERLAKEN**, in the valley between the two lakes, and **THUN**, at the other (north-western) extremity of the Lake of Thun, have mild climates and rather high mean summer temperatures. Interlaken may be used for milk and whey cures and for the grape cure in autumn. On the heights to the east of Thun is the sanatorium of **HEILIGENSCHWENDI** (3,800 feet) for poor consumptives. Close to the Lake of Thun are **BAD-HEUSTRICH** (2,300 feet) with well-known sulphur waters, and **FAULENSEEBAD** (2,600 feet). **BAD WEISSENBURG** (2,820 feet) can be reached in about 3½ hours by carriage from Thun. It lies in a deep densely wooded defile to the north of the Lower Simmenthal, and possesses weak sulphate of calcium waters, chiefly used for drinking. Mean temperature of the atmosphere for July, about 61·4° F. The place is much resorted to during summer for chronic pulmonary and bronchitic affections. **ZWEISIMMEN** (3,215 feet), further up in the Simmenthal, and **SAANEN** or **GESSENAY** (3,380 feet), near the boundary of Canton Vaud, on the high road to Château d'Oex, should likewise be mentioned here.

LAUTERBRUNNEN (2,620 feet), three-quarters of an hour by railway from Interlaken, lies very much in a hollow, and can hardly be called a health resort, though it is much visited by tourists for the sake of the waterfalls &c. **GRINDELWALD** has already been mentioned. **BRIENZ** is beautifully situated at the eastern end of the lake of that name, and, though rather hot in summer, is a

pleasant resort during spring and autumn. Baths in this part of the lake have a particularly tonic action, owing to the relative coldness of the water, which, even in the height of summer, is not warmer than 68° F. The GIESSBACH HOTEL (2,360 feet), near Brienz, is a very popular summer resort. There is likewise accommodation at the pretty village of ISELTWALD, on the southern shore of the lake, between Giessbach and Interlaken.

KURHAUS BRÜNIG (3,300 feet), in Canton Unterwalden, close to the railway station of Brünig, and near the old mountain pass of that name, is a pleasant summer resort in the neighbourhood of forests.

ESCHOLZMATT (2,815 feet), a quiet resort in the south-western part of Canton Lucern, with a station on the railway between Bern and Lucern, has a good situation amid pine woods on the watershed between Entlebuch and Emmenthal.

The **Lake of Lucern** and its neighbourhood offer a number of climatic resorts at various elevations up to four or five thousand feet or even more above the level of the lake (1,435 feet). Some of the hotels, however, especially those on the Rigi and Pilatus mountains, are, as we have already observed, too frequented by passing tourists to be suitable places for invalids requiring rest and quiet. On the northern shore of the lake, GERSAU, VITZNAU, WEGGIS, and HERTENSTEIN, sheltered towards the north by the Rigi, have a specially mild climate. Gersau has been termed the 'Montreux of the Lake of Lucern,' though it certainly has a somewhat colder and less mild winter than Montreux has. It is rather too hot in the height of summer (mean summer temperature, about 64° F.), but is better suited for spring and autumn residence. It is, however, more exposed to the south-east wind (Foehn) than Weggis and Hertenstein. BRUNNEN, situated about 4 miles to the east of Gersau, where the shore curves round towards the south, is one of the most beautiful spots on the lake, but is exposed to the north-east wind as well as the Foehn. BECKENRIED, on the southern shore, is, owing to its position, somewhat cooler than Gersau on the opposite side of the lake. LUCERN itself (latitude 47° 3' north) has a picturesque position on a western bay of the lake, facing the Rigi and Pilatus mountains. Mean temperature for the year, 49·1° F.; for May, 53·1°; for July, 64·4°. Annual rainfall, about 48 inches. Lucern has some of the features of a large and ancient town, as well as its beautiful scenery and facility for excursions, to attract visitors. It is at its best during spring and autumn, but is likewise much frequented, especially by Americans, during summer. To the west, above the town, are the hotels on the GÜTSCH (1,720 feet) and on the SONNENBERG (2,350 feet), both of them commanding magnificent views and having the advantage of adjoining pine woods. About 1½ miles

from the south-eastern extremity of the lake is **ALTORF** or **ALTDORF**, the capital of Canton Uri, celebrated in the traditions of William Tell. Its sheltered sunny position gives it, according to Gsell-Fels, a warm climate (mean July temperature 65.7° F.; September 59.7°) suitable for late spring and early autumn.

Amongst resorts of medium elevation near the Lakes of Lucern and Zug we will mention four hydrotherapeutic establishments, **SCHÖNBRUNN** (2,215 feet), **SCHÖNFELS** (3,070 feet), **FELSENEG** (3,125 feet), and **SCHÖNECK** (2,500 feet), the first three near Zug, the last on the south of the Lake of Lucern on the slope above Beckenried; the **WEISSENFLUH** Hotel (3,100 feet), above Vitznau; the **HÔTEL BÜRGENSTOCK** (2,855 feet), reached by a funicular railway from the Lake of Lucern; and the much frequented summer resorts, **Axenstein**, **Axenfels**, **Seelisberg**, and **Engelberg**. The hotels of **AXENFELS** (2,065 feet) and **AXENSTEIN** (2,460 feet), close to the village of **MORSCHACH** (2,150 feet), have rather open positions on a terrace immediately above the eastern shore of the Lake of Lucern, not far from Brunnen, and commanding magnificent views over the lake towards the west. Above the opposite shore is the well-known summer resort of **SEELISBERG** (2,630 feet), and close to it is the **KURHAUS SONNENBERG**; the latter has a fairly sheltered position in front of a fine pine forest, and is the type of a good Swiss mountain resort of medium elevation. **ENGELBERG** (3,315 feet), in Canton Unterwalden, lies in a pleasant well-sheltered valley to the north of the Titlis Mountain. Mean July temperature, 57.6° F. Mean relative humidity for July, 79 per cent. Clouds and rain are frequent during the month of June. Engelberg is also kept open during the winter for winter sports &c., but the climatic conditions and accommodation are not suited for consumptives.

The baths of **STACHELBERG** (2,050 feet), in Canton Glarus, may be mentioned partly on account of their beautiful position near the Toedi Mountain. Not far off, but at a higher elevation, is the **BRAUNWALD SANATORIUM** (3,800 feet), for poor consumptives.

ZÜRICH (1,345 feet) is famous for its beautiful situation at the north-western end of the **Lake of Zürich**, towards which the view is magnificent. Mean temperature for the year, 47.6° F.; for December, 30° F.; for July, 66.2° F. Mean annual relative humidity, 80.8 per cent. Annual rainfall, 43.3 inches. The climate is rather changeable and windy, but the attractions of an important and historic town, the beauty of the site, and its charming surroundings will always induce many, including some invalids, to stay a while at Zürich on their way to and from other places. About 25 minutes' distance from the town is the **HÔTEL DOLDER**, which has the advantage of being situated in a fine

forest of beech and pine, about 600 feet above the level of the lake. There is satisfactory accommodation for hot weather to be had on the UETLIBERG (2,830 feet), which can be reached in half an hour by railway from the city. Along the shores of the Lake of Zürich are many beautifully situated localities more or less used as summer resorts. In the Canton of Zürich, between Zürich and Zug, is the hydrotherapeutic establishment of ALBISBRUNN (2,120 feet), founded as early as 1839. At WALD (2,980 feet), to the north of the eastern end of the Lake of Zürich, is a sanatorium for pulmonary tuberculosis.

The narrow **Lake of Wallenstadt** (1,395 feet above sea-level), inclosed by steep mountains on either side, has a picturesque situation (well known to most railway travellers to the Engadine), and affords good bathing. Visitors can stay for the bathing &c. at WALLENSTADT or at WEESEN.

In the **Canton of Appenzel**, in the north-east of Switzerland, are many health resorts specially noted for their good milk and whey, where milk cures &c. can be easily carried out. Amongst such places we may mention APPENZEL, WEISSBAD, GONTEN, GAIS, and HEIDEN, the last of which has a beautiful situation, with splendid views towards the Lake of Constance on one side, and the green mountains of the Canton of Appenzel on the other. At Heiden, Dr. Frenkel in 1890 introduced his treatment for the incoordination of tabes dorsalis by methodical movements of the limbs. About 4 miles to the south-west of Heiden is TROGEN (2,970 feet), a pleasantly situated village, where Pfarrer Bion, of Zürich, founded holiday colonies ('Ferienkolonien') for poor children, and where there is likewise a sanatorium for children of the better classes, founded in 1881.

The **Lake of Constance** (1,310 feet above sea-level) may be mentioned here, though its shores are divided between Switzerland, Austria, Bavaria, Würtemberg, and Baden. Several localities on the lake are used as summer bathing resorts. The old-fashioned and historically interesting town of CONSTANCE (belonging to Baden) is beautifully situated on the Rhine, between the Obersee and the Untersee. The mean temperature of the air for summer is about 63·4° F., and the temperature of the water is seldom more than 71·5° F. BREGENZ, on the Austrian (eastern) end of the lake, is an ancient town surrounded by fine forests of pine and beech. To the east of Bregenz is the PFAENDER (3,490 feet), with beautiful views and with hotel accommodation near its summit. On the northern shore, LINDAU, in Bavaria, FRIEDRICHSHAFEN, in Würtemberg, and UEBERLINGEN, in Baden, afford good bathing; and this may likewise be obtained on the Swiss (south) shore at ROMANSHORN and RORSCHACH (mean July temperature, about 70° F.). MAMMERN, in Canton Thurgau, on the southern shore of the Untersee, is a well-known hydro-

therapeutic establishment. SCHLOSS MARBACH on the Untersee, and the KONSTANZERHOF at Constance, are sanatoriums for cardiac and nervous cases, &c.

Basel or **Bâle** or **Basle** (870 feet), owing to its position near the north-west frontier, its old cathedral, and magnificent situation on the Rhine, attracts many visitors, but cannot be termed a health resort. It is exposed to winds and is very hot in summer. Mean temperature for the year, 48·7° F.; for January, 30·6°; for July, 66·2°. Annual rainfall, 33 inches. On the south bank of the Rhine, 9 miles above Basel, are the very strong brine wells of RHEINFELDEN (885 feet), with excellent modern bathing and hotel accommodation. SCHWEIZERHALLE, on the Rhine, nearer to Basel, has similar brine wells. LIESTAL (1,030 feet), 9 miles south-east of Basel, on the railway to Olten, has brine baths and is suitable as a temporary resting place for persons passing Basel on their way to visit climatic resorts of Central Switzerland.

In the **Jura Mountains**, between Basel (latitude 47° 33' north) and Geneva (latitude 46° 12' north), are some pleasant mountain resorts of medium elevation, which we must mention here: LANGENBRUCK (2,355 feet) (with the Erzenberg Sanatorium for tuberculous children), FRIDAU (2,300 feet), and FROHBURG (2,770 feet), not far from Olten; MACOLIN or MAGGLINGEN (2,960 feet), above the Lake of Bienne; KURHAUS TWANNBERG (2,870 feet) in the same neighbourhood; and BALLAIGUES (2,815 feet), in Canton Vaud, above Vallorbe. GIMEL, ST. CERQUES, and DIVONNE, further south, have already been mentioned in connection with Geneva. YVERDON (1,430 feet), to the east of the Jura slopes, at the southern extremity of the Lake of Neuchâtel, has subthermal sulphur waters. About 16 miles by railway to the north-west of Yverdon, are the summer resorts, SAINTE-CROIX (3,635 feet), and LES RASSES (3,880 feet), the latter close to woods.

BRESTENBERG (1,575 feet), in **Canton Aargau**, pleasantly situated at the northern end of the Hallwyler See, is a well-known hydrotherapeutic establishment.

BADEN, in Switzerland (1,230 feet), has a beautiful position in the Limmat Valley, in Canton Aargau, and its thermal sulphur baths have a very old reputation in cases of rheumatoid arthritis, chronic affections of the joints, muscular rheumatism, sciatica, &c. It is only half an hour distant by railway from Zürich. The sulphur springs of SCHINZNACH (1,140 feet), in the Aar Valley, are much frequented for cutaneous affections &c., and the accommodation is satisfactory. The neighbouring village of WILDEGG possesses a muriated spring containing small quantities of iodides and bromides. Baden and Schinznach are both rather hot places in summer. Baden is decidedly pleasanter during spring and autumn, although the constant current of air produced by the swift river renders the summer heat endurable.

CHAPTER VIII

INLAND EUROPEAN RESORTS—NORTH ITALIAN LAKES, ITALY, SPAIN
AND PORTUGAL, FRANCE, BELGIUM, NORWAY AND SWEDEN

THE NORTH ITALIAN LAKES

ALTHOUGH some of the localities on the North Italian lakes are situated in Switzerland and Austria (Tirol), it is convenient to consider them all together under Italy. All these places are more or less sheltered by the Alps on the north, and their climates are of course influenced by the proximity of mountains and of sheets of water (see Chapters I and II). Differences are due to altitude, amount of shelter, &c. On the whole, the winter climate of the North Italian lakes is warmer, moister, and more equable than that of Meran; less warm, less sunny, less stimulating, and more humid, with more rain and wind, than that of the Western Riviera; and less sedative than that of Pau. Very high winds are rare, and dust is generally less than on the Riviera. There are more clear days than at health resorts in England, and snow generally falls on about 7 or 8 days only in the year. To illustrate the sunny quality of the climate of the health resorts on the North Italian lakes, we give some figures derived from the Swiss official observations (1886–1895), kindly furnished by Dr. Billwiller. They show that the duration (in hours) of sunshine at Lugano for the different months, beginning with January, is as follows: 125·3, 147·9, 189·8, 181·6, 203·6, 253·2, 285·0, 283·4, 210·5, 147·5, 99·7, 121·9; total sunshine for the year, 2,249·5 hours.

On the **Lago Maggiore** (635 feet above sea-level) the principal resorts are **LOCARNO**, in Switzerland, and **PALLANZA**, **BAVENO**, and **STRESA**, in Italy. Locarno is beautifully situated at the southern foot of the mountains which rise above the northern shore of the lake. Some of the villas are built on the slope above the town (on which is likewise the conspicuous pilgrimage church of *Madonna del Sasso*). Pallanza, Baveno, and Stresa lie on an eastern bay of the lake, the bay which contains *Isola Bella* and the other *Borromean* islands. Stresa and Baveno, on the southern shore

of this bay, are not so well sheltered as Pallanza, opposite to them, which latter is therefore to be preferred for residence in the colder seasons. Pallanza occupies the western side of a triangular tongue of land projecting into the bay southwards; the apex of the triangle forms the Punta della Castagnola, and the mountains rising above the base shelter Pallanza from the north. There are also well-sheltered spots near the shores of Lago Maggiore which as yet have not been specially utilised for invalids; for example, the slopes to the north-east of LUINO, on the eastern shore of the lake.

The **Lago d'Orta** (950 feet), with the little town of ORTA, and the **Lago di Varese** (785 feet), both belonging to Italy, are situated respectively on the west and east of the southern portion of the Lago Maggiore. The town of VARESE (1,250 feet) has an open (rather exposed) situation considerably above the level of the lake and about $2\frac{1}{2}$ miles to the north-east. It has many villas and beautiful gardens around it. The Grand Hôtel Varese lies outside the town in grounds of its own, commanding fine views of the lake, the Monte Rosa Alps, and the picturesquely situated pilgrimage chapels of Madonna del Monte.

LUGANO, in Switzerland, is the chief resort on the **Lago di Lugano**, which is the highest (905 feet) of these lakes excepting Orta. The portion of the shore of the Lake of Lugano on which the town and health resort of Lugano lie is about 3 miles in length, forming a deep sickle-shaped bay between the Monte S. Salvatore on the south and the Monte Bré on the east. The old town is in the middle, with on one side of it the new 'Paradiso' quarter—containing several large hotels and fine villas—close under Monte S. Salvatore, and on the other side, CASTAGNOLA (not to be confused with other places of the same name)—now practically a suburb of Lugano—built on the foot of Monte Bré. The western portion of the town is specially sheltered from the west and north-west by the rising ground on which the railway station (1,110 feet) and a few hotels and houses are situated. The portion least sheltered from the north is that where the Cassarate stream enters the lake. Lugano, though probably slightly less warm and sunny than Gardone-Riviera, has more variety of scenery in its neighbourhood, and a great many pleasant and not fatiguing excursions can be made. Milan, Varese, and the beautiful shores of the Lago Maggiore and Lago di Como are within easy reach, whilst the magnificent view from the summit of the Monte S. Salvatore (2,980 feet) may be readily obtained by the help of the rack-and-pinion railway.

Here we should mention MONTE GENEROSO (5,590 feet), on the Swiss and Italian frontier, between the Lakes of Lugano and

Como. It has been termed the 'Rigi of the South of the Alps,' and, like the Rigi, has hotels on it (one about 3,970 feet above sea-level, another close to the summit) which can be reached by the rack-and-pinion railway from Capolago, near Lugano.

To the north of Monte Generoso, between it and the Lake of Lugano, is LANZO D'INTELVI (3,120 feet), in the higher part of the Intelvi Valley, with a good hotel (Hôtel Belvedere) in grounds of its own, about $1\frac{1}{2}$ miles from the village, commanding beautiful views on to the lake and the Monte Rosa range to the west.

On the **Lago di Como** (700 feet above sea-level), which belongs entirely to Italy, are MENAGGIO, CADENABBIA, BELLAGIO, and CERNOBBIO. Menaggio is situated at about the middle of the western shore of the lake and has partial shelter from the north. Cadenabbia (about two miles south of Menaggio) and TREMEZZO may be regarded as a single place, for they are only separated by the Villa Carlotta, the celebrated garden of which exemplifies the luxuriant vegetation of the 'Tremezzina' shore. Cadenabbia (including Tremezzo) is well sheltered from the north and gets much sun. Though not an actual winter resort, it is as well suited as any other place on the lake for residence during the colder months. Bellagio, opposite to Cadenabbia, is a wonderfully beautiful spot, but is less sheltered and gets somewhat less sunshine. It is situated on the western side of the promontory (Punta di Bellagio) which stretches out to the north between the Lake of Como proper and the branch called the 'Lago di Lecco.' Cernobbio, with the Villa d'Este, is on the eastern shore of the lake in a position well sheltered from the north, and only about $2\frac{1}{2}$ miles from Como.

Como itself, at the south-western extremity of the lake of that name, though much visited by tourists for the sake of the fine cathedral, the beautiful excursions, &c., is an industrial city which cannot be regarded as a health resort. On an abrupt height to the east, connected with the city by a funicular railway, is the village of BRUNATE (2,400 feet), where the people of Como can often obtain bright sunshine during the winter months when the valley is in clouds.

The **Lago d'Iseo** (605 feet) has abrupt and picturesque shores, on which, however, there are no health resorts.

The **Lago di Garda** (225 feet), the largest and least elevated of the North Italian lakes, has on its western and least sheltered and sunny strip of land, termed the 'Riviera of the Lago di Garda,' including the well-known health resorts of GARDONE-RIVIERA and FASANO. At the northern extremity of the lake (in Austrian territory—Tirol) is RIVA; and in the Sarca Valley, 3 miles to the north-east of Riva, is ARCO (305 feet), in a

sheltered position, though not quite so well screened as Gardone-Riviera. These various health resorts we must now consider in further detail.

The **Riviera of the Garda Lake**, or as it is also called the 'Riviera of Salò,' is the narrow strip of land between the mountains and the lake, extending from SALÒ on the western, or more correctly the north-western, side of the lake, in a north-easterly direction as far as GARGNANO, a distance of about 11 English miles; beyond this the cliffs descend more or less abruptly to the water edge. This strip of shore, owing to its south-easterly frontage, gets a great amount of possible sunshine; it has been compared to the strip of land on the northern side of the Lake of Geneva included under the general name of Montreux,¹ but is warmer and sunnier. From Salò to Maderno—that is, to about half-way between Salò and Gargnano—the shore is sprinkled with villas and hotels, and other villas are situated on the slopes at moderate elevations above the shore. Gardone, termed GARDONE-RIVIERA (latitude 45° 37' north) to distinguish it from other Gardones, lies at about equal distances from Salò and Maderno, and it is here and at the neighbouring FASANO, which may almost be included under the name Gardone-Riviera, that the chief accommodation for winter guests is to be obtained. Following are meteorological data for Gardone² from observations made between 1885 and 1900: Mean monthly temperature for October, 56·7° F.; November, 47·8°; December, 39·7°; January, 38·3°; February, 40·6°; March, 47·3°; April, 55·2°. During these seven months, which include the season in the widest sense of the term, the mean daily range of temperature is 11·5° F., and there are only about 3 days on which snow falls, and 30½ days on which the nocturnal temperature falls below freezing point; during the same period the total rainfall is 25½ inches; the mean relative humidity is 76 per cent.; and there are 1,128 hours (435 during the three winter months) of sunshine and 133 days without wind. Lemons are much cultivated here, but require a certain amount of artificial shelter from the occasional great variations of temperature. The visitors (mostly German-speaking) at Gardone include convalescents from acute diseases, various pulmonary cases, and many overworked persons and others who merely require a winter holiday in a pleasant, healthy, sheltered, and fairly warm locality. The communications are by the

¹ Which might, indeed, for comparison with the 'Liburnian Riviera' about Abbazia, and the 'Riviera of the Garda Lake,' be termed the 'Riviera of the Lake of Geneva,' just as the Undercliff about Ventnor might, by a similar stretch, be termed the 'Riviera of the Isle of Wight.'

² See *Gardone-Riviera am Garda See als Winterkurort*, by Dr. K. Koeniger, fourth edition, Berlin, 1901.

steamboats which call on their way between Desenzano at the southern, and Riva at the northern, end of the lake. Moreover, Salo is connected by steam tramway with Brescia, and can also be reached in about $1\frac{1}{2}$ hours by carriage from the railway station of Desenzano. On the little promontory of Sirmione (where the poet Catullus had a villa) projecting from the southern shore of the Garda Lake is the village and mineral water resort of SIRMIONE, whose hot (104° F.) muriated-sulphur spring rises from the bed of the lake; it is open during the spring, summer, and autumn.

RIVA, a thoroughly Italian town, though belonging to Austria, is beautifully situated at the northern extremity of the Lake of Garda. It is a pleasant place for a visit in spring or autumn, has facilities for bathing in the lake, and now possesses a first-class hotel (Hôtel Lido), but is not sufficiently sheltered from the north and north-east to be considered a winter health resort for delicate invalids. Mean temperature for the three winter months, 38.8° F.

ARCO, in the Sarca Valley, 3 miles to the north-east of Riva, is a bright modern-looking Austrian health resort, with an old town and the picturesquely situated ruins of an ancient castle. It has about the same mean winter temperature as Riva, but is better sheltered from winds. On the west rise the heights of the Brenta, &c., and on the east is the lofty Monte Baldo; on the north (especially the north-east) and on the south it is less protected, though immediately to the north rises the castle hill, and to the south, towards Riva, the valley is partially closed by the isolated Monte Brione, which helps to shut off the southerly valley winds from the Lago di Garda. Arco is a genuine winter health resort. It has a fairly sheltered and sunny winter climate of medium humidity, and can be visited by patients who do not require or cannot visit one of the warmer more southern winter resorts. It possesses facilities for hydrotherapy and for inhalation treatment. Here is likewise the St. Pancratius Sanatorium for tuberculosis. Dr. M. Kuntze points out that the season can last longer at Arco than at Gardone-Riviera, because at the latter place, owing to its peculiar situation, hot summer weather is earlier felt than at the former.

The health resorts on the North Italian lakes are too hot for most invalids during the hottest months of the year (the mean July temperatures reach 70° to over 74° F.), but are good spring and autumn resorts, and in many cases may be used as intermediate stations in passing from a summer to a winter resort, and conversely. Pallanza, Locarno, Lugano, Gardone-Riviera, and Arco are all open to invalids during the winter; their mean temperatures for the three winter months (December to February)

are respectively as follows: Pallanza, 37.4° F. (Scharrenbroich); Locarno, 37.2° (calculated from E. de la Harpe); Lugano, 36.7° (from de la Harpe); Gardone-Riviera, 39.6° (K. Koeniger); Arco, 38.7° (Reimer). These figures may be compared with those for Meran (35.2°) and Montreux (35.4°). During the three winter months Lugano gets apparently 395 hours of actual sunshine, about 176½ more than Montreux, and about 88 more than Davos-Platz. Gardone-Riviera is a still sunnier place. Yet the 435 hours of actual sunshine which, according to Koeniger, Gardone-Riviera can claim during winter (December to February), amount to only 53 per cent. of the possible duration, whilst the 307 hours which Davos-Platz gets during the same period equal 58½ per cent. of the possible; Torquay and Hastings in England get only 24 to 26 per cent. of the possible. The mean winter relative humidity at Lugano is about the same as at Gardone-Riviera (76 or 77 per cent.).

OTHER ITALIAN INLAND RESORTS

Italy contains many mineral water health resorts, and some mountain stations at various elevations above sea-level.

The baths of BORMIO lie at the head of the Valtellina, on the southern side of the Stelvio route, near the frontiers of Switzerland and Tirol. The new baths (4,380 feet) and the old baths (4,750 feet) are both frequented during July and August for their simple thermal waters. The chalybeate waters of SANTA CATARINA (5,600 feet) are only 3 miles distant. In the Valtellina, above the village of SONDALO, is the SONDRIO SANATORIUM (4,100 feet above sea-level), the first sanatorium for pulmonary tuberculosis in Italy, opened in 1903.

In the Val Bognanco, south of the Simplon, 4½ miles by carriage road to the west of Domodossola (Italian terminus of the Simplon railway), is the little health resort of BOGNANCO (2,300 feet), suitable for a stay in late summer and autumn. It possesses gaseous earthy-alkaline chalybeate waters, and likewise a weakly mineralised gaseous spring, which may be used as a table water.

In the southern Monte Rosa valleys we must mention MACUGNAGA (4,125 feet); ALAGNA (3,955 feet); GRESSONEY-LA-TRINITÉ (5,370 feet); and GRESSONEY-ST. JEAN (4,495 feet).

ANDORNO (1,800 feet), in the Val d'Andorno, is a popular summer resort, pleasantly situated 3 miles north of Biella. VARALLO (1,480 feet), the chief place of the Val Sesia, is likewise visited during summer. Several establishments in the neighbourhood of Biella, Andorno, and Varallo have arrangements for hydrotherapeutic treatment.

COURMAYEUR (4,015 feet), to the south of Mont Blanc, is much frequented by Italians as a summer resort; not far off are the simple thermal baths of PRÉ-SAINT-DIDIER (3,280 feet). Further south, near the Gran Paradiso Mountain, are the chalybeate springs of CERESOLE REALE (5,290 feet above sea-level).

RECOARO (1,400 feet), a summer resort with chalybeate springs, and a good centre for excursions, lies in a picturesque neighbourhood at the head of the Val d' Agno, to the south of the Tirolese Alps, and is connected with Vicenza by a steam tramway.

Amongst the various simple thermal, sulphur, and muriated springs of Northern Italy we will note the following: ABANO and BATTAGLIA, a few miles from each other, at the eastern foot of the isolated Euganean Hills, near Padua; the baths of VALDIERI (4,425 feet), situated in the Maritime Alps close to the French frontier; the baths of VINADIO (4,360 feet), in the same district; and the well-known baths of ACQUI (450 feet, Province of Alessandria). All these spas (especially Battaglia) are noted for the local application of a hot mud ('fango'), obtained from the thermal springs, and employed in chronic articular affections &c.

ORMEA, a picturesque summer resort pleasantly situated in the Ligurian portion of the Maritime Alps, at an elevation of 2,400 feet above sea-level, is connected by railway with Turin on the north, and is only 31 miles from the station of Oneglia on the Riviera coast. CERTOSA-DI-VAL-PESIO (2,825 feet), a summer resort and hydrotherapeutic establishment (originally, as the name implies, a Carthusian monastery), stands amidst fine chestnut trees, in the picturesque Val Pesio, to the north-west of Ormea. Further south, in a valley of the southern declivity of the mountains, is the summer resort (formerly an abbey) of SAN DALMAZZO-DI-TENDA (2,250 feet), near the French frontier.

We now come to two of the best known spas in Italy, namely, Salsomaggiore and Bagni di Lucca. SALSOMAGGIORE (520 feet), in the Province of Parma, is situated in a shallow valley of the north-eastern declivity of the Apennines, about 36 minutes by steam tramway from the railway station of Borgo-San-Donnino. Its muriated waters and the mother lye ('acqua madre') derived from them are much employed for baths and inhalation treatment. The accommodation is now excellent. Two miles distant are the cold sulphur waters of TABIANO in a picturesque valley.

BAGNI DI LUCCA (400 to 1,000 feet) is situated in the beautiful valley of the Lima, 15 miles north of the town of Lucca, from which it may be reached in about an hour by the new railway. The thermal sulphate of calcium baths are suitable for cases likely to be benefited by simple thermal treatment, douches, &c.

Many of the visitors merely come for amusement and change of air. Of the three villages which help to make up the spa, BAGNI CALDI (1,000 feet) and VILLA are the most frequented by English visitors; PONTE A SERRAGLIO may, however, be regarded as the central of the three. There is an English medical man resident during the season. LUCCA itself is an ancient but clean city, the ramparts of which have been converted into a broad encircling promenade, commanding beautiful views of the plain and neighbouring wooded hills.

In the Val di Nievole (Province of Lucca) are likewise the tepid muriated springs of MONTECATINI (920 feet), the waters of which are employed internally and externally for dyspeptic conditions &c., and the natural hot vapour bath of MONSUMMANO, to which Garibaldi and Louis Kossuth came for treatment. The GROTTA OF MONSUMMANO was accidentally discovered in 1849 by the father of the poet, Giuseppe Giusti. The spacious interior, lined by stalactites and stalagmites, is carefully kept clean and is illuminated by electric lights. It is fancifully divided into a 'Paradiso,' a 'Purgatorio,' and an 'Inferno.' The temperature of the last, the hottest portion of the cavern, is about 95° F.; that of the natural thermal lakes, which heat the air and produce the vapour bath, is about 92° to 95° F. The patients, men and women, clad in a comfortable kind of dressing-gown, walk about or rest in the grotto, and mostly perspire freely in spite of the temperature being relatively low for a vapour bath. After remaining there for the prescribed time—generally about an hour—they rest on couches, as after ordinary forms of sweating baths. A tepidarium has been added to the natural cavern, and there is a large tepid piscina for a plunge. Arrangements have likewise been made for hydrotherapeutic treatment. The season is from April to September. Patients can either lodge at the modern hotel adjoining the grotto or at Montecatini, which is only about 2 miles distant. The treatment is often useful in chronic cases of painful disorders, such as lumbago, sciatica, &c. On the railway between Pistoja and Bologna are the thermal sulphur waters of PORRETTA (Province of Bologna), situated in a valley of the Apennines, at an elevation of 1,150 feet. At some distance to the west of the railway, and reached by a drive of several hours from Pracchia (2,025 feet, the highest station of the railway), are two summer resorts in the Apennines, the ALBERGO DELL' ABETONE, beautifully situated in a forest, at an elevation of 4,520 feet above sea-level, and CUTIGLIANO (2,215 feet), somewhat nearer to the railway.

CASTRO-CARO, to the east of the Apennines, near the station of Forlì, has muriated waters containing iodides and bromides.

In the Apennines, to the east of Florence, we may mention CAMALDOLI¹ (2,720 feet) and VALLOMBROSA (3,140 feet), with its fine woods, both formerly famous for their monasteries; likewise BAGNO-IN-ROMAGNA (1,640 feet), 6 hours by carriage from Forlì, with thermal alkaline waters and mud baths.

CHIANCIANO (1,800 feet), in the valley of Chiana, not far from Montepulciano, in Central Italy, has thermal earthy waters chiefly used for bathing.

ALBANO, or, as it is officially called, ALBANO LAZIALE (1,250 feet), and FRASCATI (980 feet), on the Alban Mountains to the south-east of Rome, with their beautiful villas and magnificent prospects, have always been favourite resorts of the Romans. There are likewise pleasant little villas at CASTEL GANDOLFO, above the Alban Lake, and at ROCCA DI PAPA, close to the Monte Cavo summit. Spring and autumn are the best seasons for the Alban Mountain resorts ('Castelli Romani').

Amongst larger Italian towns, the interesting ancient cities of PERUGIA (1,700 feet above sea-level) and SIENA (1,000 to 1,150 feet), though not exactly health resorts, may be mentioned as suitable localities to make a halt at in spring or autumn, owing to their good accommodation and moderate elevation above sea-level. Venice and Naples have already been mentioned amongst Mediterranean climates (Chapter IV); and Rome, Florence, and Milan will be referred to later on amongst the 'Large Towns of Europe' (Chapter XI).

INLAND HEALTH RESORTS OF SPAIN AND PORTUGAL

The Spanish or southern valleys of the Pyrenees would, one might suppose, afford more suitable sites for climatic resorts of high altitudes than the French side. Yet at present the choice of such localities is extremely limited. PANTICOSA, situated close to the French frontier, in Huesca, at an elevation of about 5,600 feet above sea-level, is sometimes visited by foreign as well as by Spanish invalids (including many cases of chronic pulmonary tuberculosis) for the sake of its mountain climate and its weakly mineralised subthermal waters. The season, however, only lasts from the middle of June to the middle of September. We understand that there is a sanatorium for tuberculosis in the NAVAS Mountains, about 3,940 feet above sea-level. The national 'Porta Coeli Sanatorium' (1,280 feet) is an old monastery in a sheltered position, transformed into an establishment for the modern

¹ 'Camaldoli' merely means a Camaldulensian monastery. There are many suppressed monasteries of this order in other parts of Italy. This Camaldoli is beautifully situated amidst a pine forest in the Casentino (i.e. Upper Arno Valley).

open-air treatment of pulmonary tuberculosis. Of places in the mountains which are to some extent used as summer resorts by the Spaniards, the upper village of ESCORIAL, that surrounding the famous Escorial palace and monastery (3,500 feet), may be mentioned here. It has a bleak and exposed position on an almost bare and rocky mountain slope, and, although the accommodation is very limited, is resorted to by people from Madrid during the great heat of summer. The interesting town of AVILA has an altitude of about 3,650 feet above sea-level. In Portugal BUSACO or BUSSACO (1,800 feet), in the Serra-de-Busaco, famous on account of an ancient monastery and Wellington's victory of 1810, is used by the Portuguese as a summer climatic resort. The fine hotel stands on a hill, in a forest of oaks, cedars and cypresses, and commands a beautiful view of the mountains and neighbouring country, including the University city of Coimbra, about 20 miles distant to the south.

The number of mineral water health resorts in the Iberian Peninsula is very great. We may mention FITERO (Navarra), CALDAS-DE-OVIEDO (Oviedo), and SACEDON (Guadalajara) in Spain, and CALDAS-DE-GEREZ (Minho) in Portugal, amongst the simple thermal waters. CALDAS-DE-MONTBUY (Barcelona), CALDAS-DE-MALAVELLA (Girone), and CESTONA-GUESALAGA (Guipuzcoa), all in the north of Spain, have thermal muriated waters. TRILLO (Guadalajara) has subthermal muriated chalybeate waters containing a little sulphuretted hydrogen. CARRATRACA (Malaga) and SANTA AGUEDA (Guipuzcoa) possess cold sulphur springs. The following spas all possess thermal sulphur waters: LIEDESMA (Salamanca), MONTEMAYOR (Caceres), CORTEGADA (Orense), CARBALLINO (Orense), CARBALLO (Coruna), ONTANEDA (Santander), ARCHENA (Murcia), and CALDAS-DE-RAINHA, CALDAS-DE-VIZELLA, and SAN PEDRO-DO-SUL, all three in Portugal.

VIDAGO, in the north of Portugal, has alkaline waters used in the same class of cases as those of Vichy. URBEROAGA-DE-ALZOLA, near San Sebastian, in Spain, with weak alkaline earthy waters, has somewhat misleadingly been termed the 'Spanish Vichy.' The Spanish sulphated purgative waters, CONDAL, RUBINAT, CARABANA, and VILLACABRAS, are a good deal exported.

SEVILLE will be mentioned under the 'Large Towns of Europe' (see Chapter XI).

THE FRENCH ALPS

We shall for convenience arrange the French health resorts into geographical groups, beginning with the Alps.

The French shore of the Lake of Geneva and the resorts of

the Voirons and Salève Mountains have already been referred to under Switzerland. CHAMONIX (3,450 feet), the well-known mountaineering resort (now connected by electric railway with the station of Le Fayet-St.-Gervais, and thus with Geneva), to the north-west of the Mont-Blanc chain, lies in a valley, through which the Arve stream flows; it offers good accommodation, but is obviously more suitable for tourists than invalids. Its climate is much milder than that of the HÔTEL MONTANVERT, the most tonic place in the Mont-Blanc district, situated above the Mer-de-Glace, at an elevation of 6,300 feet above sea-level. ARGENTIÈRE, further up the Chamonix Valley, 5 miles to the north-east of Chamonix, has a somewhat higher elevation (3,960 feet) than the latter place, and is close to the large glacier of Argentière. Chamonix is visited as a holiday resort by healthy persons during winter as well as during summer, especially in December and January for the tobogganing, sleighing, &c.

Saint-Gervais-les-Bains (Haute Savoie) lies to the south of the Arve Valley, to the west of the Chamonix Valley. The baths (2,075 feet) are situated in a wooded gorge, whilst the village (2,680 feet) is situated in a more open and sunny position higher up the mountain side. The thermal springs contain a little sulphate of sodium, sulphate of calcium, and common salt, and one of them contains sulphuretted hydrogen. They are employed internally and externally in cutaneous affections, chronic gout, chronic rheumatism, &c. The season is from the beginning of June to the end of September.

Aix-les-Bains, the celebrated Savoy health resort (860 feet), lies about $1\frac{1}{2}$ miles to the east of the beautiful and picturesque Lac du Bourget (745 feet above sea-level), and at the foot of Mont-Revard (5,360 feet). The thermal sulphur waters are chiefly employed for douches and baths of various kinds, and especially for the 'Aix-douche' or 'douche-massage' treatment. The conditions treated include chronic disorders of the joints, sciatica, neuralgias, muscular rheumatism, and a great variety of gouty and rheumatic manifestations. The gay life and aristocratic society during the season attract many visitors. The climate of Aix is a mild one, and the establishment is open throughout the year, but the season includes spring, summer, and winter. At MARLIOZ, about ten minutes' walk to the south of Aix, is a cold sulphur spring, with excellent inhalation and spray rooms. The hotel on the summit of MONT-REVARDE may be reached by a rack-and-pinion railway from Aix, so that persons for whom the summer heat of Aix is too trying may be transferred to a high altitude resort of over 5,000 feet above sea-level. Owing, however, to its position on the mountain top, the hotel is too much exposed to

winds for delicate invalids. In colder weather the less elevated situation of LES CORBIÈRES (2,200 feet), with a station on the Mont-Revard Railway, is preferable. The COL-DU-CHAT (2,090 feet), above the opposite shore of the Lake of Bourget, likewise affords some accommodation.

Annecy and some other places afford accommodation near the beautiful Lake of Annecy. The lake is situated at an elevation of 1,470 feet above sea-level, amidst meadows, vineyards, and mountains, and this neighbourhood might well be selected in many cases for a stay in spring or autumn. **ALBERTVILLE** (1,180 feet), on the railway from Chambéry to Moutiers, may likewise be chosen for a stay by those who are able to make excursions in the neighbourhood, but neither the climate nor the present accommodation entitles it to be regarded as a health resort.

Brides-les-Bains (1,860 feet) is pleasantly situated in the Tarentaise (southern part of Savoy), in the deep valley of the Doron de Bozel, $3\frac{1}{2}$ miles from the railway station of Moutiers (Moutiers-en-Tarentaise). The waters contain small quantities of the sulphates of sodium, magnesium, and calcium, with some common salt, and though not exactly similar to the waters of Carlsbad, may be often successfully employed in the same kinds of cases. **SALINS-MOUTIERS** (1,610 feet) lies lower down the valley, between Brides and the railway station. It possesses gaseous thermal muriated waters which can be used in similar cases to those treated at Nauheim in Germany. **PRALOGNAN** (4,670 feet), a well-sheltered mountain climatic resort, open in the summer only, can be reached by a drive of $3\frac{1}{2}$ hours from Brides.

LA BAUCHE (1,640 feet), which has a charming position in a broad fertile valley, with the rocky cliffs of the L'Épine Mountains on the east, and with a view of the Grand Chartreux range on the south, may be used as a quiet summer resort.

CHALLES (880 feet), about 3 miles by steam tramway from Chambéry, possesses cold sulphur springs much used for sprays &c. in chronic catarrhal conditions of the upper respiratory passages.

ALLEVARD (1,400 feet), in a pleasant mountain valley to the east of the railway between Chambéry and Grenoble, has cold muriated sulphur waters and an excellent thermal establishment, with inhalation rooms &c.

GRENOBLE (700 feet), though not itself a health resort, is a great tourist centre and is visited by many persons on their way to places in the French Alps, partly for the sake of the mountain excursions to be made in the neighbourhood.

Uriage-les-Bains (1,350 feet) lies amidst woods, in a beautiful

valley about 8 miles from Grenoble, with which it is connected by steam tramway. Its thermal muriated sulphur waters may be roughly compared to those of Aachen, in Germany. Many skin affections connected with disorders of the general nutrition are especially likely to be benefited, and the treatment of syphilis is carried out on similar lines to that at Aachen. A stay at Uriage is useful for many scrofulous and weakly children.

There is no mountain-resort for invalids at present available near Grenoble, though accommodation at various elevations in the Grande Chartreuse range can be obtained, for instance, near ST. PIERRE-DE-CHARTREUSE (2,785 feet) and LE SAPPEY (3,280 feet). Further away to the east from Grenoble there are LE MONËTIER-DE-BRIANÇON (4,890 feet) and BRIANÇON (4,330 feet), near the Italian frontier.

LAMOTTE-LES-BAINS, with thermal muriated waters, is situated in a pleasant Dauphiné valley, near the railway, about 23 miles to the south of Grenoble. An old château (2,130 feet above sea-level) has been converted into the thermal establishment.

AIX (Bouches-du-Rhone), the 'Aguæ Sextiæ' of the Romans, and the old capital of Provence (590 feet), has simple thermal waters, but is of historic rather than medical interest. It has a station on the railway between Grenoble and Marseilles.

GRÉOULX (Basses Alpes), with thermal muriated sulphur waters, lies at an elevation of 1,140 feet, about 1½ hours from Mirabeau, a station on the line from Grenoble to Marseilles.

Further to the north-east is DIGNE (1,960 feet), with similar waters and a thermal establishment not far off in the valley of Eaux Chaudes.

Thorenc (Alpes Maritimes) is a new summer mountain resort situated at an altitude of nearly 4,200 feet, near a forest of firs, in the Thorenc Valley. It may be regarded as the best climatic summer resort in the South of France. It is kept open from the middle of May to the end of October, and can be readily reached by those who have wintered on the Riviera in 4½ hours by carriage from Grasse, in 5½ hours from Cannes, and in 6½ from Nice. Mean temperature for July, about 62° F.; for September, about 52·3° F. The valley is imperfectly sheltered from the 'mistral,' but well sheltered from other winds.¹ ST. MARTIN-VÉSUBIE or ST. MARTIN-LANTOSQUE (3,120 feet) is a summer resort of somewhat lower altitude, 36½ miles to the north of Nice, close to the Italian frontier.

¹ See A. Philip and M. Esmonet, *La Haute Vallée de Thorenc*, 1898.

THE FRENCH PYRENEES

The Pyrenees differ considerably from the Swiss Alps, partly owing to their more southern latitude and lower average height. The Pyrenees lie between latitudes 42° and $43^{\circ} 30'$ north, whilst the greatest heights of the Alps (Mont Blanc, Monte Rosa, &c.) lie in latitude $45^{\circ} 50'$ or further north. The average height of the Pyrenean chain is only 6,000 feet, whilst the average height of the Swiss Alps is 11,000 feet. The snow level on the southern slopes of the Pyrenees is about 10,000 feet, and on the northern slopes about 9,000 feet, whilst in the Swiss Alps it is from 100 to 2,000 feet lower. Glaciers are fewer and smaller in the Pyrenees, and trees and vegetation flourish at a considerably higher level than in Switzerland; trees grow at a height of 6,000 feet on the northern slopes and 7,500 feet on the southern slopes. The zones of vegetation and the snow-line rise somewhat from west to east. There are far fewer high altitude health resorts in the Pyrenees than in Switzerland, and no winter resorts of high altitude comparable to Davos, St. Moritz, and Arosa. In the Pyrenean district there are no inland lakes like the famous Swiss and Italian lakes with their much frequented health resorts. The thermal sulphide of sodium springs are the most important mineral springs of this region; some of them, especially those of the Eastern Pyrenees, are more or less 'degenerate' sulphide waters, giving an alkaline reaction and containing a little sodium sulphate and sodium carbonate; they are less rich in sulphide of sodium than the typical Pyrenean waters. In considering the Pyrenees health resorts we shall commence from the eastern end (Department of Pyrénées Orientales).

Amélie-les-Bains (920 feet), in the 'Vallespir,' as the portion of the Tech Valley above Céret is called, has a mild winter climate, and is visited especially during the winter season by patients with chronic catarrhal affections of the respiratory organs &c. The summer is very hot. In connection with the thermal sulphur springs there is a large military hospital. The Tech Valley has a general downward direction of south-west to north-east, and at Amélie it is in great part sheltered from the cold and biting north-west wind which blows with great violence over the plain of Roussillon. On the other hand, the north-east wind blowing up the valley from the sea may sometimes be too much felt, as may likewise the south wind, especially during summer. H. Lamarque points out that the portion of the valley at the foot of the Montbolo Hill, near the railway station, is especially protected from the north, north-west, and north-east; this locality, which forms the favourite promenade during winter, receives

the maximum amount of sun and has been called the 'Petite Provence.'

PRATS-DE-MOLLO (2,620 feet), on the mountain slope, higher up the valley, about 14 miles from Amélie, has a position which H. Lamarque considers admirably adapted for winter residence.

LA PRESTE-LES-BAINS (3,700 feet), further from Amélie (20 miles), has pleasant shady walks and alkaline thermal sulphur waters with a reputation in chronic urinary affections.

LE BOULOU (275 feet), in the Tech Valley below Céret, has subthermal simple alkaline waters, and has been termed by Garrigou the 'Vichy of the Pyrenees.'

Vernet-les-Bains, or **LE VERNET** (2,060 feet), is pleasantly situated in a southern branch of the Tet Valley, at the northern foot of the Canigou Mountain, which here separates the Tet Valley from the Tech Valley ('Vallespir'). The thermal sulphur springs and bath arrangements are well managed, and though the chief season is in summer, one of the thermal establishments is kept open throughout the year. There are shady promenades in the neighbourhood. A little above Le Vernet, at an altitude of 2,100 to 2,500 feet, facing south-west, are the sanatorium galleries of the Mont-Canigou Sanatorium (season, October to April inclusive), founded in 1890 with Dr. Charles Sabourin as medical director. This was the earliest of the modern sanatoria for pulmonary tuberculosis in France.

The thermal sulphur baths of **MOLITG** (1,475 feet), about 5 miles from the railway station of Prades, are situated in the narrow valley of the Castellane, close to its junction with the Tet. They have a reputation in cutaneous affections.

OLLETTE (2,010 feet), in the Valley of the Tet, above Prades, likewise has thermal sulphur waters. **LES ESCALDES** (4,430 feet), in the Department of Pyrénées Orientales, close to the Spanish frontier, and a place of the same name in the neighbouring small independent state of Andorra, both have thermal sulphur springs.

RENNES-LES-BAINS (1,040 feet), in the Department of Aude, possesses muriated as well as thermal weakly mineralised waters.

AX-LES-THERMES (2,340 feet), in the upper part of the Ariège Valley, has very hot springs (up to 171.5° F.) and excellent thermal sulphur baths. It is a quiet spa. **USSAT** (1,590 feet), lower down the Ariège Valley, 14 miles by railway from Ax, has simple thermal baths, used for gynæcological affections &c.

Bagnères-de-Luchon, one of the most fashionable and frequented of French summer resorts, has a picturesque situation (2,050 feet) on the western side of a broad level valley, surrounded by mountains in almost every direction; the spa is in the Department of Haute Garonne, close to the Spanish frontier. The

thermal sulphur waters are used for baths, douches, and inhalations in cutaneous affections, syphilis, chronic rheumatic disorders, &c. The climate is subject to rather sudden changes.

Bagnères-de-Bigorre (1,805 feet) is pleasantly situated in the Valley of the Adour, in the Department of Hautes Pyrénées. Its mineral springs may be divided into three groups: (1) simple thermal and thermal earthy, somewhat analogous to those of Bath in England; (2) non-gaseous chalybeate waters; (3) the cold sulphur waters conveyed from LABASSÈRE (7½ miles distant). Bagnères-de-Bigorre has a mild climate, and is likewise used as a simple climatic station. It is open all the year round, but the chief season is during the summer. The spa is often visited by tourists in connection with the ascents of the 'Pic du Midi de Bigorre' (9,440 feet), high up on which there is now a certain amount of accommodation to be had.

Cauterets (3,200 feet), situated in the typical Pyrenean valley of the Gave de Cauterets, rivals Luchon in the number of invalids and visitors who flock there during the season (end of May to beginning of October). There are several thermal sulphur springs and several thermal establishments. The spring of La Raillère, most frequently employed for internal use, is nearly a mile higher up the valley (to the south of Cauterets) and forms a centre of spa life from seven to ten o'clock in the morning. Cauterets has a special reputation in chronic catarrhal affections of the respiratory passages. The excursion to the Pont d'Espagne (4,880 feet) and the Lac de Gaube (5,710 feet) is one of the attractions for robust visitors.

In the Valley of the Gave de Gavarnie, which joins the Gave de Cauterets at Pierrefitte, is situated **St. SAUVEUR** (2,500 feet), with well-known thermal sulphur baths which have a special reputation in gynæcological cases.

The thermal sulphur baths of **BARÈGES** (4,200 feet); in the valley of the Gave de Bastan, have a great reputation in old gunshot and other wounds, painful cicatrices, and chronic joint affections. The waters of **BARZUN**, below Barèges, which are similar in character to those of the latter spa, are conducted to **LUZ**, where the valley in which Barèges lies joins the valley in which St. Sauveur lies. **GAVARNIE** (5,085 feet), a small village, near the entrance to the famous **CIRQUE DE GAVARNIE**, 12 miles up the valley from St. Sauveur, should be mentioned here, as it affords tolerable accommodation to persons needing a higher altitude than that afforded by St. Sauveur, Cauterets, &c.

Eaux Bonnes (2,460 feet) and **EAUX CHAUDES** (2,050 feet) are situated 5 miles apart from each other, in two prolongations of the Ossau Valley, about 26 miles to the south of Pau. Both

these spas possess thermal sulphur waters, those of Eaux Bonnes being employed chiefly internally, in chronic affections of the respiratory organs, and those of Eaux Chaudes chiefly in the form of baths and douches for gynaecological affections &c.

ST. CHRISTAU (985 feet), with weakly mineralised waters, is prettily situated in the Vallée d'Aspe, to the south of Oloron.

SALIES-DE-BÉARN (100 feet), in the Department of Basses Pyrénées, has possibly the best known brine baths in France. The waters resemble those of Nantwich, in England. The climate is mild and very hot in summer.

SALIES-DU-SALAT (960 feet), in the Department of Haute Garonne, has much weaker muriated waters (3 per cent.), and a sanatorium for weakly children.

We have still to speak of Pau, Argelés, Dax, and Cambo.

Pau (620 feet), the old capital of Béarn, lies on elevated ground on the north side of the river Gave de Pau, in latitude 43° 20' north, and is the chief town of the Department of Basses Pyrénées. Its position to the north of the Pyrenees, not far from the Atlantic, and the higher ground on its north, give it a mild rather sedative winter climate. Mean temperature¹ for November, 46·8° F.; December, 43·2°; January, 41°; February, 43·3°; March, 48·2°; April, 54°. Rain or snow falls on about 70 to 90 days during these months, and the mean relative humidity is about 82 per cent. The winter climate of Pau is not so warm, but more equable than that of the Western Riviera; there is less sunshine, as well as more rain, at Pau, but cold winds are more frequently felt on the Riviera, and there is altogether less wind at Pau than at the majority of health resorts. On the other hand, the winter at Pau is warmer than at Montreux or Meran. The climate is suitable for crethic constitutions and for catarrhal conditions of the respiratory passages with dry irritable cough. Not far from Pau, on the head of a slope facing south, is the **TRESPOEY SANATORIUM** for consumptive patients (695 feet), a small establishment open from the middle of October to the middle of May. One of the glories of Pau is its broad sunny promenade (called the *Boulevard des Pyrénées*) to the south of the town, on the high ridge (about 660 feet above sea-level) on which the chief hotels are situated. It extends from the ancient royal castle to the *Palais d'Hiver* (new casino) and commands a superb view to the south over the beautiful Valley of the Gave towards the chain of the Pyrenees.

Argelés (1,520 feet), in the Department of Hautes Pyrénées, lies in a broad part of the Valley of the Gave de Pau, 9½ miles to

¹ Hann gives slightly different figures.

the south of Lourdes. There is a bath establishment, supplied with sulphur waters from GAZOST, 10 miles distant. The situation is most beautiful and the accommodation good. During the summer season Argelès is very hot, but it is a pleasant intermediate climatic station during spring and autumn.

DAX (130 feet), well known for its mud baths and simple thermal springs, is situated in the Department of Landes, considerably nearer to the coast than Pau. Its climate is therefore more under the Atlantic influence, but it has little shelter from winds. Dax is open all the year round. Its mean winter temperature is said to be slightly higher than that of Pau.

CAMBO (200 feet), on the Nive, 12 miles by railway south-east of Bayonne, lies partly in the valley, but chiefly on a plateau above the right bank of the river. The sulphur and chalybeate springs are three-quarters of a mile distant. The summer is very hot, and the spring and autumn much pleasanter. On account of its pleasant situation in a beautiful country, away from factories and large towns, and on account of its relatively mild climate, Cambo has been chosen by some persons for winter residence. As a place for winter residence it may be regarded somewhat like Pau, but simpler, quieter, and of course less expensive.

THE AUVERGNE MOUNTAINS, THE CEVENNES, AND CENTRAL FRANCE

The volcanic mountains of **Auvergne**, situated almost in the centre of France, between the 45th and 46th degrees of latitude north, are rich in mineral waters. The Mont-Dore group, amidst which lie the spas of Mont-Dore and La Bourboule, possesses the highest summit (Puy-de-Sancy, 6,185 feet). To the north of this group, on the lower slopes of the Puy-de-Dôme (4,800 feet), is the much frequented spa of Royat.

Royat (1,480 feet), beautifully situated at the entrance of the Tiretaine Valley, is $1\frac{1}{4}$ miles to the west of Clermont-Ferrand, with which it is connected by train and electric tramway. The view from Royat over the fertile plain of Limagne, towards the Forez Hills on the east, is magnificent. The thermal muriated alkaline springs, on which account Royat has sometimes been called the 'French Ems,' have a great reputation in chronic gout, rheumatoid arthritis, chronic catarrhal conditions of the respiratory organs, &c. The springs of Royat contain more or less bicarbonate of iron, as well as common salt and bicarbonate of sodium. Royat is a fashionable spa, very much frequented during the season, especially from the middle of June to the middle of August, and the hotel accommodation is first class.

At DURTOL, not far from Royat and Clermont-Ferrand, is a sanatorium for consumptives, opened in 1898, under the direction of Dr. Charles Sabourin, previously the medical director of the Canigou Sanatorium. It has a sheltered position near pine woods, at an elevation of 1,705 feet above sea-level.

Mont-Dore (3,440 feet) lies in the deep valley of the commencement of the Dordogne, well sheltered by the surrounding heights. Its springs may be classed in the simple thermal group, though they contain a minute quantity of arsenic; they are chiefly used for inhalation, pulverisation, foot baths, douches, and ordinary baths, in chronic catarrhal affections of the respiratory organs, &c. The climate undoubtedly aids the treatment in many cases, especially perhaps in certain cases of asthma. The new thermal establishment is one of the finest in Europe. The season lasts from the middle of June to the middle of September.

La Bourboule (2,780 feet), 4 miles lower down the stream from Mont-Dore, possesses thermal muriated alkaline waters distinguished from other waters of the same class by the amount of arsenic they contain (equivalent to 0.028 grammes arseniate of sodium in a litre of the Source Perrière-Choussy). La Bourboule is of use in chronic catarrhal conditions of the respiratory organs, feeble gouty and rheumatic patients, chronic malarial troubles, &c. The season at La Bourboule is about a month longer than at Mont-Dore.

SAINT-NECTAIRE (2,500 feet), in another Auvergne valley, has thermal muriated alkaline waters somewhat analogous to those of Royat, but the life is simpler and less fashionable than that at the latter spa.

Châtel-Guyon (1,300 feet), an Auvergne spa (Puy-de-Dôme) much frequented by the French, has thermal waters containing chlorides of magnesium and sodium, and bicarbonates of calcium, sodium, iron, and lithium. The climate during the height of the season may be very hot.

The waters of **RENLAIGUE** and **CHÂTEAUNEUF**, likewise in the Department of Puy-de-Dôme, may be classed as gaseous chalybeate and alkaline chalybeate.

CLERMONT-FERRAND (1,300 feet), formerly the capital of Auvergne, may be mentioned here as being much visited by persons undergoing treatment at the various Auvergne spas, and as being closely connected by train and electric tramway with Royat. The summer is very hot (mean July temperature, 66.6° F.), but at the end of the spa season it is cooler. Living is, of course, less expensive than at Royat, and many interesting excursions can be made in the neighbourhood.

CHAUDÈS AIGUES (2,050 feet), in the Department of Cantal, possesses exceedingly hot simple thermal waters (up to 180° F). The Sanatorium of DIENNE (Cantal), for pulmonary tuberculosis, lies on the Cantal mountain group, 4,260 feet above sea-level.

Further to the south, on the mountains of AUBRAC (Department of Aveyron), at an elevation of 4,590 feet above sea-level, there is the Aubrac Sanatorium (for pulmonary tuberculosis).

We will now proceed to the southern part of the **Cevennes**.

LAMALOU-LES-BAINS (620 feet), in a valley of the southern part of the Cevennes, in the Department of Hérault, has thermal chalybeate waters, much used for baths in cases of tabes dorsalis, chronic affections of the nervous system, neuralgias, &c. It is a summer resort, though the establishment is likewise open during the winter. Mean annual temperature said to be as high as 59° F. Only about 38 rainy days in the year. There are likewise arrangements here for treating ataxia by careful methodical exercises after the plan of Frenkel, of Heiden.

BAGNOLS-LES-BAINS (2,600 feet), in the Valley of the Lot, in the Department of Lozère, possesses thermal sulphur waters, which, it is interesting to note, were employed about 1859 or earlier by a local doctor (Dufresse de Chassaigne) in chronic affections of the cardiac valves.

Vals-les-Bains (790 feet) lies in a picturesque valley of the northern Cevennes, on the banks of the Volane stream, near its junction with the Ardèche. It is famous for its cold simple alkaline springs, and has been termed the 'cold Vichy.'

LE PUY, the old capital of Velay, may be mentioned here, though it can scarcely be termed a health resort. It is picturesquely situated on the slopes of Mont Anis, at an elevation of 2,340 feet above sea-level. Mean temperature for the year, 49·1° F.; for January, 32·5°; for July, 66·6°.

On MONT-PILAT (Loire), one of the chief mountains of the northern Cevennes, there is accommodation at an altitude of about 3,940 feet above sea-level.

Vichy (740 feet), possibly the best known health resort of France, is situated on the right bank of the Allier, in a rather flat and uniform country. It is famous for its simple alkaline springs (chiefly thermal), and is resorted to by the various classes of invalids which can derive benefit from alkaline waters. Its climate and amusements are not very unlike those of Paris. CUSSET, 2 miles from Vichy, in a somewhat more picturesque country, has cold alkaline waters. HAUTERIVE and SAINT-YORRE, a few miles from Vichy, have likewise cold alkaline waters, which are much exported.

In the district inclosed between the Loire and its tributary the Allier we may mention likewise: SAIL-LES-BAINS, with simple thermal waters containing a mentionable amount of alkaline silicates in solution; and CHÂTELDON, RENAISON, SAINT-ALBAN, and SAIL-SOUS-COUZAN, all with gaseous waters containing bicarbonates of calcium and sodium, which can be used as table waters. The source of the better known table waters of SAINT-GALMIER is close to this district, but on the other (eastern) side of the Loire.

ST. HONORÉ-LES-BAINS (990 feet) is a pleasantly situated summer resort in a well-wooded hilly country at the western foot of the Morvan Mountains, which shelter it on the east and north-east. It possesses tepid sulphur waters employed for inhalation treatment, douches &c. in chronic catarrhal affections of the respiratory organs.

POUGUES-LES-EAUX (650 feet), on the right bank of the Loire, about 8 miles to the north of Nevers, has cold alkaline earthy waters, with a casino in a pleasant park. The waters have a reputation in various digestive and urinary disorders.

Somewhat southwards of the two last-mentioned spas are BOURBON-LANCY (780 feet) and BOURBON-L'ARCHAMBAULT (870 feet), with weak thermal muriated waters. To the south-west of the latter place are the simple thermal baths of NÉRIS-LES-BAINS (1,150 feet), and the more primitive EVAUX-LES-BAINS (1,500 feet).

Before leaving Central France we may mention another private sanatorium for pulmonary tuberculosis, the 'Sanatorium des Pins' (490 feet), in a pleasant situation, sheltered by woods, at LAMOTTE-BEUVRON, a station on the railway 24 miles to the south of Orleans.

THE FRENCH JURA

SALINS (1,200 feet) has a picturesque position in the narrow valley of the Furieuse stream, in the midst of the Jura Mountains. Its brine baths (about 2 per cent.) are much employed for weakly children. LONS-LE-SAUNIER (840 feet), in a much broader valley on the outskirts of the Jura, has a 30 per cent. brine. LA MOUILLÈRE (830 feet), a suburb of BESANÇON, possesses a newly erected thermal establishment, supplied with very strong (29 per cent.) brine from MISEREY, $3\frac{1}{2}$ miles distant. The view on to the old city and the heights above it is picturesque. Mean annual temperature of Besançon, 51.2° F.; January, 35.1° F.; July, 68.2° F.

DIVONNE has already been mentioned with Switzerland.

HAUTEVILLE (Department of Ain) is a picturesquely situated

summer resort in the south of the Jura, $8\frac{1}{2}$ miles from the station of Tenay (on the railway between Lyons and Geneva. A sanatorium for poor consumptives has been erected here by the people of Lyons, aided by the Government, and was opened in 1900. It is situated on the eastern slope of the plateau of Hauteville-en-Bugey, above the village, not far from a pine forest, at an elevation of 2,990 feet above sea-level.

THE FRENCH VOSGES

CONTREXÉVILLE (Department of Vosges) is situated at an elevation of about 1,150 feet above sea-level, in a shallow valley, on a plateau connected with the Monts Faucilles, and during the main part of the season (middle of June to middle of September) can be reached by special trains in 6 hours from Paris. The sulphate of calcium waters have a great reputation, and are taken in rather large quantities internally in cases of uric acid gravel, oxaluria, chronic gouty disorders, gouty diabetes, &c. (see Part II).

VITTEL (1,100 feet) and MARTIGNY-LES-BAINS (1,200 feet), a few miles from Contrexéville, have somewhat similar waters (see Part II).

BOURBONNE-LES-BAINS (900 feet), in the Department of Haute Marne, pleasantly situated in hilly ground belonging to the Monts Faucilles, has rather weak thermal muriated waters which are much used for douches and baths in chronic rheumatoid arthritis, chronic sciatica, the remains of injuries to joints, &c. They are likewise employed internally. Treatment by hot forcible douches is much employed in cases of sciatica &c.

PLOMBIÈRES (1,300 feet), situated in a narrow valley of the Vosges, has simple thermal waters, which are employed for baths and douches in the various disorders ordinarily benefited by simple thermal waters. In certain cases of chronic diarrhoea and in the chronic remnants of localised peritonitis (notably appendicitis), Plombières has acquired a special reputation.

LUXEUIL-LES-BAINS (1,300 feet), on fairly level ground at the western foot of the Vosges Mountains, with simple thermal waters, is about $12\frac{1}{2}$ miles distant from Plombières. BAINS-LES-BAINS (980 feet), in a valley of the Vosges, likewise has simple thermal waters. BUSSANG (2,200 feet), not far from the Alsatian frontier, has gaseous chalybeate waters containing a minute amount of arsenic.

Gérardmer (2,200 feet), the most popular summer resort on the French side of the Vosges, is situated amidst wooded hills to the east of the Lake of Gérardmer. Amongst the numerous excursions to be made from this centre, one of the most popular

is that to the SCHLUCHT, as the mountain pass from the French valley of Gérardmer to the Alsatian Valley of Münster is called. At the summit of the pass (3,775 feet) is a French hotel, and on the Alsatian side of the frontier the HÔTEL ALTENBERG (3,300 feet), on a plateau amidst pine trees, above the Münsterthal, affords first-class accommodation.

INLAND RESORTS OF THE NORTH OF FRANCE

In the neighbourhood of Paris, VERSAILLES (420 feet), with its park, the suburbs of AUTEUIL, with its pleasant villas, ENGHIEU-LES-BAINS (160 feet) and PIERREFONDS (275 feet), with their sulphur waters, and SAINT-GERMAIN-EN-LAYE and FONTAINEBLEAU, with their grand forests, may be used for spring, early summer, or autumn residence. There are likewise many old places in Brittany and Normandy which can be chosen for their pure country air.

BAGNOLES-DE-L'ORNE (530 feet), situated in a deep valley in the picturesque district termed the 'Norman Switzerland,' has thermal weak sulphur baths which have been recommended for a tendency to phlebitis.

ST. AMAND-LES-BAINS (100 feet) is situated in the Département Nord, not far from the Belgian frontier. It adjoins a large forest and is noted for its mud baths.

In the northern parts of inland France there are now several popular sanatoria for consumptives and for tuberculous and weakly children. For consumptives we may specially mention those of Bligny (Département Seine et Oise), Angicourt (Oise), and the recently opened 'family sanatorium' of Montigny-en-Ostrevent (Nord). Near Nancy is the Lay-St. Christophe Sanatorium for consumptives. Amongst sanatoria for children and adolescents are Villiers-sur-Marne, Ormesson, Villepinte, Champ-rosay, and Forges-les-Bains, all in the Département Seine et Oise. There are likewise 'agricultural colonies' for tuberculous convalescents at Noisy-le-Grand (Seine et Oise) and other localities.

INLAND BELGIUM AND LUXEMBOURG

There are several places in the Belgian **Ardennes** which may be visited for their pure air. **Spa** (1,000 feet) has a beautiful position in a sheltered valley of the Ardennes, surrounded by wooded slopes affording shady promenades. Its gaseous chalybeate waters have an old-established reputation in anæmic conditions &c., and during the season (May to October) it is visited by invalids and their friends of every nationality. Near Spa, in

a position sheltered by woods and higher ground, is the Bourgoumont Sanatorium for pulmonary tuberculosis, about 1,360 feet above sea-level. CHAUDFONTAINE, not far distant, has simple thermal waters. The country between Rochefort, Dinant, and Namur is very pleasant, and may be roughly compared to the Peak district in England. At DINANT there is a hydrotherapeutic establishment under medical guidance. The hotel recently erected on the site of the ancient citadel of NAMUR, 200 or 300 feet above the Meuse, must, owing to its open and airy position, be a refreshing resort for warm weather. It is connected with the town by a funicular railway. On a plateau above the Valley of the Meuse in the Province of Namur is the Montsur-Meuse Sanatorium (650 feet) for consumptive patients. The CHÂTEAU D'ARDEENNE, 790 feet above sea-level, in the fine park of the royal domain of Ardenne, with a station on the railway between Dinant and Jemelle, has been converted into a hotel, and is a good summer resort, though not well sheltered from winds. Amongst the interesting excursions which can be made in this neighbourhood, are those to the famous caverns of Han and of Rochefort.

The Grand Duchy of **Luxembourg** has likewise some healthy localities for summer residence. A great portion of the north and west has an elevation of more than 1,000 feet above sea-level. MONDORF (650 feet), near the south-eastern frontier, has sub-thermal muriated waters. The town of LUXEMBOURG itself, the best portion of which lies on an exposed plateau, about 930 feet above sea-level, is strikingly picturesque and has beautiful shady walks, which render it an agreeable place for visiting during the warmer months.

INLAND NORWAY AND SWEDEN

The Scandinavian peninsula is in great part mountainous and in this respect it must be remembered that a mountain locality in Norway or Sweden can exert a bracing effect on invalids and healthy persons equal to that produced by climates of considerably higher altitude in the Swiss Alps. According to A. Magelssen¹ the 'high altitude climates' ('Høifjelds' or 'Alpine' climates), which in the Swiss Alps we have in this book reckoned as commencing at about 3,500 feet above sea-level, commence in Central Germany at 3,000 feet and in the more southern parts of Norway at between 2,500 and 3,000 feet. Below this come what in Norway are termed the 'Høilids'

¹ See his pamphlet on 'Norway as a Winter and Summer Health Resort, English edition, Christiania, 1906.

climates, that is to say, the 'subalpine' climates or climates of medium altitude.

We may first mention ST. OLAFS-BAD, with mud baths &c., one of the most popular health resorts of Norway. It is picturesquely situated at an elevation of 500 feet, not far from the cobalt mines of Modum, and $2\frac{1}{2}$ miles to the west of the railway station of Vikersund. HOLMENKOLLEN (about 1,040 feet) is a summer and winter resort, only about 5 miles from Christiania; the Sanatorium, suitable for cases requiring a tonic climate of moderate elevation, is kept open throughout the year. EIDSVOLD (410 feet), with a chalybeate spring, has a railway station 42 miles to the north-east of Christiania; the Eidsvoldsbad is open from the beginning of June to the end of August.

The TONSAASEN SANATORIUM, in the beautiful VALDERS district, is situated amidst pine forests on the slopes of the Tonsaas, at an elevation of 1,980 feet above sea-level, an elevation which in regard to its effects is, as we have already stated, climatically equivalent to a considerably higher one in Switzerland. This health resort is open winter as well as summer, and part of it is occupied exclusively by tuberculous patients. The GAUSDAL HØIFJELDS-SANATORIUM (2,370 feet), in the beautiful Gausdal valley, about ten miles from the railway station of Tretten, is open from the middle of June to the end of August (for nervous disorders &c.). The LAUVAASEN HØIFJELDS-SANATORIUM (3,000 feet) is open during the summer season only. The TØRTE HØILIDS-SANATORIUM (1,900 feet), a few miles from the Hundtorp railway station, is open all the year round. The MESNALIEN SANATORIUM (1,800 feet), about ten miles to the east of Lillehammer, is for the treatment of chest diseases.

The establishment of LOKA, near Filipstad, in Sweden, is situated amidst very picturesque scenery, and is well known for its old-established mud baths. The patient sits on a stool, and is massaged with the mud by three attendants.

Besides the Tonsaasen and Mesnalien Sanatoriums there are, in Norway and Sweden, various other establishments for the sanatorium treatment of pulmonary tuberculosis, amongst others the Grefsen Sanatorium (near Christiania) for paying patients, and the Reknaes Sanatorium (near Molde) and the Lyster Sanatorium (near Bergen) for poor patients. The three Swedish Royal Jubilee Sanatoria (Hålahult, Hessleby, and Österåsen) contain about 320 beds between them.

CHAPTER IX

INLAND EUROPEAN RESORTS—GERMANY, AUSTRIA-HUNGARY,
ROUMANIA AND BULGARIA, RUSSIA

GERMANY AND AUSTRIA-HUNGARY

IN describing the inland health resorts of Germany and Austria-Hungary¹ we shall first of all take the districts bordering on the Rhine, commencing at the north and including the Eifel, the Taunus, the Hardt Mountains, the Alsatian Vosges, and the Black Forest. We shall then proceed in the following order: the Harz Mountains, the Thüringer Wald, the Erzgebirge and Riesengebirge, other regions of Germany (including Pymont, Oeynhausien, Wildungen, Kissingen, &c.), the Bavarian Highlands and Eastern Alps (Tirol &c.), the Bohemian spas, and other health resorts of the Austro-Hungarian Empire.

Various districts of Germany and Austria have a medical interest not only on account of the regular health resorts they include, but just as much, or even more so, on account of the peculiar facilities and inducements they afford for the kind of leisurely touring (whether by walking, cycling, driving, or railway) in a pure air, amidst picturesque scenery, which is one of the best remedies in many cases of mental overwork &c.

Specially suitable for such tours of various lengths, both on account of scenery and on account of the great number of places affording suitable accommodation, are the districts of the Rhine between Bonn and Bingen, the Eifel and Moselle Valley, the Taunus, the Vosges, the Black Forest, the Harz Mountains, Thuringia, the Saxon Switzerland, the Erzgebirge, the Riesengebirge, the Bavarian Highlands, and various parts of Tirol.

RHENISH PRUSSIA AND THE NORTHERN RHINE COUNTRY

CLEVE (180 feet), in Rhenish Prussia, close to the Dutch boundary, formerly capital of the Duchy of Cleve, has magnificent views and woodland walks, and is much visited as a summer

¹ We have not thought it necessary to mention all the numerous sanatoria for consumptive patients and scrofulous and weakly children which have been so successfully established during recent years in various parts of Germany.

resort by Dutch families. The moderate elevation of the hills of Cleve is of some importance, owing to the flatness of the surrounding country. Its chalybeate spring is not effervescent, like the well-known springs of Spa, Pyrmont, &c. On the wooded hills, about 2 miles to the south of the town, is the pleasant resort of BERG-UND-THAL.

Here we may likewise mention the neighbouring summer resort BERG-EN-DAL, on the Dutch side of the frontier, 3 miles to the east of the interesting old town of NIJMEGEN, with which it is connected by steam tramway. The hotel is situated on a ridge to the south of the Rhine Valley, which it overlooks, at about 280 feet above the valley level.

Aachen, or Aix-la-Chapelle (530 feet), the Aquisgranum of the Romans, and the favourite residence of Charles the Great, lies near the Belgian frontier, in a broad depression, amidst gently sloping hills which afford a certain amount of protection from winds. Mean temperature for the three summer months, 61·9° F.; for the three winter months, 37° F. The total amount of sunshine at Aachen is not very great. Following are the average numbers of hours of sunshine for the various months (mean of years 1897 to 1904), commencing with January: 49·0, 66·3, 85·5, 132·6, 178·2, 192·2, 220·8, 202·0, 135·2, 112·0, 71·8, 47·7; total annual sunshine, 1,493·3 hours (*cf.* table of sunshine values at various places in Europe given in the section on Light in Chapter I). The beautiful Aachener Wald is connected with the town by electric tramway, and shady walks may be enjoyed there during hot weather, or else on the Lousberg, a wooded hill to the north of the town. The size and industrial importance of the city somewhat modifies its character as a general health resort, but the bath arrangements and accommodation for invalids are excellent, and adapted not only for the wealthy, but also for persons of more or less restricted means. The thermal muriated sulphurous waters are employed chiefly for baths and douches; massage and various forms of Swedish gymnastics are made use of in suitable cases. The Aachen treatment of syphilis consists in the methodical employment of antisyphilitic measures (chiefly mercurial inunction) simultaneously with balneotherapeutic measures, and the great reputation of the spa in syphilitic disorders of all periods depends doubtless largely on the great attention which has been paid to the subject by the local medical men. The baths are open all the year round. BURTSCHIED, a suburb of Aachen, has similar but hotter springs, the temperature of one of them reaching 167° F.

The banks of the Rhine between Bonn and Bingen offer many picturesque places suitable as summer and autumn resorts.

We need only mention GODESBERG, ROLANDSECK, KÖNIGSWINTER, HONNEF, NEUWIED, BOPPARD, and ST. GOAR. There are some well-known hydrotherapeutic establishments in this region: GODESBERG, BENDORF, LAUBBACH (near Coblenz), and MARIENBERG and MÜHLBAD (near Boppard). Laubbach has a pleasant sheltered position on the west of the Rhine Valley 2 miles to the south of Coblenz.

Above HONNEF, on the south-western slope of the Siebengebirge, is the Sanatorium of HOHENHONNEF, under Dr. E. Meissen's direction, for the treatment of pulmonary tuberculosis. It faces south-west, and is about 520 feet above the level of the Rhine at Honnef, that is, about 770 feet above sea-level.

On the PETERSBERG (1,095 feet), one of the summits of the **Siebengebirge**, there is now good hotel accommodation, which can be reached by a rack-and-pinion railway from Königswinter. Amongst the valleys, woods, and ridges of the **Westerwald**, the hilly district on the right side of the Rhine and to the north of the Lahn, of which the Siebengebirge forms the north-western end, there are many situations suitable for residence in late spring, summer, and autumn, but at present there is little accommodation for visitors. Homely lodgings, however, may be found at RENGSDORF (960 feet above sea-level), about 7 miles to the north of Neuwied. Near WALDBREITBACH, about 7 miles to the north-west of Rengsdorf, is the new Sanatorium of Waldbreitbach for poor consumptives, on a slope (790 feet above sea-level) sheltered from the north and partly from the east winds.

On the wooded summit of the NIEDERWALD (1,080 feet), connected with Assmannshausen by a rack-and-pinion railway, there is limited accommodation. RÜDESHEIM and ASSMANNSHAUSEN, on the right bank of the Rhine, at the foot of the Niederwald, both celebrated for their wines, may be used for the grape cure in autumn. The latter place likewise possesses tepid muriated alkaline waters containing lithium bicarbonate.

NEUENAHN (260 feet) has a fairly sheltered position in the Ahr Valley, $6\frac{1}{4}$ miles from Remagen. It has sometimes been termed 'the German Vichy,' but its thermal alkaline waters are much more weakly mineralised than those of the French spa. Special attention has been paid to glycosuric cases at Neuenahr. Close to Neuenahr is the spring of the Apollinaris table water.

The mountainous district called the **Eifel**, with its rather bleak-looking plateaus, is an extensive area between the Rhine and its tributary the Moselle, between the towns of Coblenz, Treves, and Aix-la-Chapelle. As summer resorts in the Eifel we may mention AHRWEILER (340 feet) and ALTENAHN (345 feet), in the Ahr Valley above Neuenahr (the latter, 9 miles from Neuenahr,

is much more picturesquely situated), the LAACHER SEE (900 feet), GEROLSTEIN (1,230 feet), and BAD BERTRICH (540 feet), the last place with mineral waters resembling those of Carlsbad, but only about one-third as strong. BAD TOENNISTEIN, in the Brohlthal, has gaseous muriated alkaline waters somewhat resembling those of Selters. The gaseous waters of GEROLSTEIN and NIEDERMENDIG and the more strongly alkaline waters of BIRRESBORN, near Gerolstein, which are all exported as table waters, bear witness likewise to the richness of this district in mineral waters. COCHEM, and a few other places on the Moselle, between Coblenz and Treves, may, as summer and autumn resorts, be compared to the beautiful and picturesque localities on the Rhine, but are quieter.

KREUZNACH (340 feet) lies on the Nahe, about 10 miles to the south of its junction with the Rhine at Bingen. The brine baths ('Soolbäder') of Kreuznach, often strengthened with 'Mutterlauge' (mother-lye), are much used in scrofulous affections of children, in chronic disorders of the pelvic organs in women, and in chronic cutaneous affections. The cold Elisabethquelle, the spring chiefly used for drinking, contains in a thousand parts about ten parts sodium chloride and two parts calcium chloride. There are arrangements for inhalation of the water on the Wassmuth system, as well as by the older method of the 'Gradirhäuser.' Kreuznach is too hot for some persons during the height of summer, and there is scarcely sufficient shade in the neighbourhood, except in the Kurgarten. Mean temperature for the year, 50·2° F.; for the three summer months, about 70° F. Mean annual relative humidity, 74·9 per cent. There are probably not more than 20 rainy days during the summer months.

About 1½ miles south of Kreuznach, in a narrower and rather more picturesque portion of the Nahe Valley, is MÜNSTER-AM-STEIN (380 feet), with similar but warmer waters. The season at both places is from the beginning of May to the end of September.

EMS (260 feet) is beautifully situated in the narrow Valley of the Lahn, 7½ miles from its entry into the Rhine at Niederlahnstein. Its thermal muriated alkaline waters have obtained a great reputation in chronic catarrhal affections of the respiratory organs, and are employed for drinking, gargling, inhalation treatment, &c., and for baths and douches. When there is emphysema, Waldenburg's or some other method for inspiration from air of increased density, and expiration into air of diminished density, is frequently employed. The thermal baths and vaginal douches are often made use of for chronic catarrhal affections of the uterus &c. The mean summer temperature at Ems is 64·4° F., and the

midday heat during summer may be oppressive, though a considerable fall of temperature takes place when the sun sets behind the sides of the valley. During the hot weather the shady walks on the hills are pleasant for those who are able to take them, and by a funicular railway patients can quickly reach the wooded summit of the Malberg, about 1,090 feet above sea-level.

At NASSAU (265 feet), on the Lahn, 5 miles to the east of Ems, is a much frequented establishment for hydrotherapeutic treatment. Between Nassau and Limburg-on-the-Lahn is FACHINGEN, the cold gaseous alkaline water of which is extensively used in Germany. The weakly mineralised gaseous 'Johannis' table water is obtained from near ZOLLHAUS, to the south of Limburg, and further to the east is NIEDERSELTERS, the source of the gaseous muriated alkaline water commonly known as 'natural Seltzer,' which up to the middle of the nineteenth century was almost the only gaseous table water in general use.

THE TAUNUS MOUNTAINS

The Taunus district, to the north of the Main, between Mainz and Frankfurt, is rich in health resorts and mineral waters.

WIESBADEN (380 feet) (latitude 50° 4' north), formerly the capital of the Duchy of Nassau, one of the most frequented health resorts of the world, is beautifully situated at the southern foot of the western part of the Taunus range, about 2½ miles to the north of the Rhine. The valley in which Wiesbaden lies opens southwards into the Rhine Valley, and is sheltered from cold winds. The mean temperature for summer is given as 65·4° F.; for autumn, 50° F.; for winter, 33·4° F.; for spring, 49·4° F. Mean relative humidity, about 78 per cent. The thermal muriated waters of Wiesbaden are used for drinking (especially the Kochbrunnen) in gouty conditions &c., and notably in chronic catarrhal affections of the respiratory organs, for which the mild climate of the health resort is favourable. The baths and douches are largely prescribed for chronic gout, chronic neuralgias, muscular rheumatism, &c. Syphilis is treated by a combination of antisyphilitic and balneotherapeutic measures as at Aachen. The middle of summer is too hot for many persons, but spring and autumn are very agreeable parts of the year. The beautiful walks in the neighbouring woods afford grateful shade during hot weather. Wiesbaden is kept open the whole year round, but is rather cold as a winter resort. It is a suitable locality for milk cures, and in autumn for the grape cure. There

are several good establishments in Wiesbaden and its neighbourhood where ordinary hydrotherapeutic treatment, and treatment by massage, special exercises, and electricity can be carried out.

Not far distant, on the summit of the NEROBERG (800 feet), which can be reached by funicular railway, there is hotel accommodation which might be used for a change from Wiesbaden.

About 4 miles from Wiesbaden, in a well wooded and sheltered position on the southern declivity of the Taunus, 980 feet above sea-level, with beautiful views over the Rhine and Main plains, is the NAUROD SANATORIUM for consumptive patients of limited means, opened in 1901 by the Nassau Sanatorium Association; it is 1 mile from the railway station of Niedernhausen.

Likewise in the western portion of the Taunus range are the spas of Schlangenbad and Schwalbach. SCHLANGENBAD (900 feet) is situated in a deep densely wooded valley having a southerly direction towards the Rhine, which is about 5 miles distant. Mean summer temperature, 63·8° F. The simple thermal baths of Schlangenbad are some of the best known in Germany, and have a special reputation in insomnia and functional nervous disorders associated with weakness and irritability. SCHWALBACH, or, more correctly, LANGENSCHWALBACH (950 feet), lies in a valley on the northern side of the Taunus range, about 4½ miles to the north of Schlangenbad. The mean summer temperature is given as 61·4° F. The Schwalbach waters are gaseous chalybeate, and are used in the same class of cases as those of Spa in Belgium &c. There are now golf links at Schwalbach.

In the more eastern portion of the Taunus are Königstein, Cronberg, Soden, Homburg, and Nauheim. To the south of the Taunus, between Wiesbaden and Frankfurt, lies BAD-WEILBACH (440 feet) with sulphurous and muriated alkaline waters.

KÖNIGSTEIN (1,190 feet) and CRONBERG (1,015 feet) are popular summer resorts, quickly reached from Frankfurt-am-Main. Cronberg is particularly well sheltered from cold north winds. Near Königstein, and 2½ miles from the railway station of Cronberg, is the establishment of FALKENSTEIN (1,315 feet), the well-known sanatorium for pulmonary tuberculosis, in a fairly sheltered position on the southern declivity of the Taunus. The name of Dettweiler will always remain as inseparably connected with the Falkenstein Sanatorium as that of Brehmer with Goerbersdorf. At RUPPERTSHAIN, about 3 miles to the west of Königstein, is a large sanatorium (1,310 feet) for consumptive patients of the poorer classes.

SODEN IN THE TAUNUS (450 feet), at the southern foot of the Taunus Mountains, 7 miles to the west of Frankfurt, has several gaseous muriated springs, differing from each other in temperature (52° F. to 86° F.) and in the amount of common salt (2 to 15 per mille) and free carbonic acid they contain. The mild climate (mean summer temperature, 65·6° F.) is suitable in some irritable catarrhal conditions of the respiratory organs. Formerly the waters were much prescribed for drinking in cases of pulmonary tuberculosis.

HOMBURG or HOMBURG-VOR-DER-HÖHE¹ (600 feet) lies on elevated ground at the south of the Taunus range, half an hour distant by railway from Frankfurt. Its open position, exposed towards the north, makes the climate (mean summer temperature given as 62·6° F.) cooler than that of neighbouring localities on the Main. This fashionable spa is much frequented for its cold gaseous muriated springs, which, besides common salt, contain various amounts of bicarbonate of iron, sometimes enough to be termed chalybeate. In Part III of this volume we shall refer to the utility of Homburg in chronic gout and various other disorders. For the more robust visitors to Homburg there are many excursions to higher altitudes in the neighbourhood, such as to the Roman fortress of the Saalburg (1,340 feet), the summits of the Altkönig (2,385 feet), and the Grosser Feldberg (2,900 feet, the highest point in the Taunus). There is accommodation on the top of the Feldberg, but the position is of course not sheltered from any winds.

NAUHEIM (400 feet), at the north-eastern foot of the Taunus, has gaseous thermal muriated waters, and of late years has attracted world-wide attention, chiefly owing to the treatment of cardiac affections by gaseous baths and methodical exercises, as introduced by the brothers Schott at this health resort. We shall again refer to the Nauheim treatment in Part III of the present volume.

The Taunus district possesses also several gaseous muriated alkaline springs, not too highly mineralised to be used as 'table waters.' We need only mention those of CRONTHAL, near Cronberg, and the LUDWIGSBRUNNEN and SCHWALHEIMERBRUNNEN, near Nauheim.

RHENISH BAVARIA

In the Rhenish Palatinate, in the region of the **Hardt** or **Haardt**² Mountains, are several places which can be used for the

¹ 'Die Höhe' is another name for the 'Taunus.'

² The Hardt or Haardt Mountains are the northern portion of the Vosges (German, Vogesen). Haardt, Hardt, Hard, Hart, Harth, and Haar, seem all to signify forest or

grape cure in autumn. Commencing in the north, we will mention some of them in the following order: DÜRKHEIM (380 feet), with brine baths; NEUSTADT-AN-DER-HAARDT (460 feet); EDENKOBEN (485 feet); and GLEISWEILER (1,020 feet); these places all lie under the eastern declivity of the mountains. The Gleisweiler establishment has probably the pleasantest and most sheltered situation. Rather further south is ANNWEILER (590 feet), an old town in the Valley of the Queich, near magnificent woods and the famous ruins of Trifels and Madenburg. The grapes of the Rhenish Palatinate are somewhat less sweet than those of Montreux and Meran.

ALSATIAN RESORTS

NIEDERBRONN (620 feet), with muriated waters, lies at the eastern foot of the **Vosges**, in a pleasant valley of the most northern portion of Alsace. HOHWALD (2,000 feet), situated amidst beautiful pine forests, about 8½ miles from the railway station of Barr, is one of the most popular summer resorts of the Vosges. Amongst other summer resorts of this region are the ODILIENBERG (2,470 feet) and the DREI AEHREN (1,910 feet), much frequented by tourists, the latter on a hill overlooking the Münsterthal and the Rhine Valley. The ALTENBERG HOTEL, at the head of the Münsterthal, has already been alluded to in speaking of the French Vosges, although it belongs to the German part of Alsace. We may here likewise mention ALTWEIER (2,620 feet), in an open position not far from Rappoltsweiler. RAPPOLTSWEILER itself, situated at a much lower elevation (820 feet), has subthermal waters and is used as a climatic resort in cases of pulmonary emphysema, &c.

THE ODENWALD

In the country to the east of the Rhine, between Darmstadt and Heidelberg, there are several places used as summer resorts, such as JUGENHEIM (530 feet), AUERBACH (330 feet), and WEINHEIM (345 feet), all on the 'Bergstrasse,' as the ancient road which skirts the western slopes of the Odenwald is called;¹ and LINDENFELS (1,170 feet), in the midst of the Odenwald, 11 miles by road from the railway station of Bensheim on the

wooded hill in German names of places. Thus, there is a Hardt-Wald near Karlsruhe, a Harth-Wald near Berka in Thuringia, and a Hard-Wald in the Taunus near Homburg. The Harz Mountains were also anciently called Hart.

¹ The word 'Bergstrasse' is frequently used to signify the country bordering the road.

Bergstrasse. Lindenfels is situated on the projecting spur of a southern declivity, sheltered by wooded heights on the north and north-east, and commanding extensive views over the adjoining country to the south, east, and west. There are pleasant walks in the neighbouring woods, the accommodation is fair, and owing to its situation and the picturesque ruins of an ancient castle, Lindenfels is by some considered the most beautiful place in the whole Odenwald. In the north-eastern part of the Odenwald, $2\frac{1}{2}$ miles from the railway station of Höchst, is the Ernst-Ludwig-Heilstätte, opened by an insurance company in 1901 for the sanatorium treatment of male patients of the poorer classes. It has a good sheltered position in a well-wooded side-valley of the Mümling, about 850 feet above sea-level.

THE BLACK FOREST REGION

The mountain range of the Black Forest, or Schwarzwald (latitude 49° to $47^{\circ} 30'$ north), extends over the region to the east of the Rhine Valley between Karlsruhe and Basel (Bâle). It is famous for its pine-clad valleys, its varied and picturesque scenery, and, especially from a medical point of view, for its numerous climatic and mineral water health resorts. The health resorts are mostly open only from about the middle of May to the end of September (the height of the season is between the middle of June and the middle of August), but a few of them, such as Baden-Baden and St. Blasien, and of course the Nordrach-Colonie Sanatorium, remain open throughout the year.

Baden-Baden (650 feet) is situated at the north-western foot of the Black Forest, in the lower part of the Oos Valley, close to the fertile plain of the Rhine. There is good shelter from cold winds, and the climate is mild and moderately moist. Mean temperature for the year, 48° F.; for spring, 48° ; for summer, 62.4° ; for autumn, 47.6° ; for winter, 34.3° . The heat of the middle of summer is too great for some persons, chiefly on account of a certain degree of stagnation of the atmosphere caused by the surrounding hills. The thermal weak muriated waters (2 per mille common salt) are used for drinking, particularly in chronic catarrhal affections of the respiratory mucous membranes, but are chiefly employed like simple thermal waters for baths and douches in chronic gouty affections, rheumatoid arthritis &c. in delicate subjects. The thermal establishments include excellent hot-air and vapour baths, Zander's medico-mechanical appliances &c. Baden is not merely visited for its climate and baths, but on account of the wonderful beauty of its situation, the variety of the excursions which can be made, the

excellent accommodation, and the fashionable character of the resort. It is admirably adapted for gradual walking and climbing exercise (the 'Terrain-Cur' of Professor Oertel) under medical guidance, and during autumn is likewise a suitable locality for the grape cure. It is often selected as an intermediate climatic station on the way to or from warmer winter resorts, and as a locality for an 'after-cure' ('Nachkur') after courses of more active mineral waters.

The following localities in the hills, at some distance to the south of Baden-Baden, may be mentioned as summer resorts: PLAETTIG (2,550 feet), SAND (2,730 feet), HUNDSECK (2,920 feet), HERRENWIES (2,500 feet), and WIEDENFELSEN (2,265 feet). GERNSBACH (525 feet) and ROTHENFELS (460 feet), pleasantly situated in the Murgthal to the east and north-east of Baden-Baden, though of rather low elevation, are likewise used as summer resorts.

Wildbad (1,410 feet), in the Kingdom of Württemberg, nearly due east of Baden-Baden, is situated in the deep pine-clad Valley of the Enz, in the north-eastern part of the Black Forest. Mean summer temperature, about 62·2° F. Its simple thermal springs, chiefly employed in the form of baths and douches, are useful in the class of cases likely to be benefited by the simple thermal baths (German, 'Wildbäder') in general, aided by the mild mountain and woodland climate.

At **SCHÖMBERG** (2,130 feet), not far from Wildbad, is a sanatorium for the open-air treatment of consumptive patients.

LIEBENZELL (1,100 feet), situated in a pleasant valley, about 8 miles to the east of Wildbad, has similar waters, but their temperature is lower (72° to 82° F.), so that they have often to be heated for bathing purposes.

At **HIRSAU** (1,120 feet), situated on the Nagold stream, 2½ miles from Liebenzell, surrounded by beautiful woods, and celebrated for the ruins of an ancient monastery, is a private sanatorium for nervous affections, convalescents &c.

HERRENALB (1,230 feet), with a hydrotherapeutic establishment, is a beautiful summer resort about 11 miles to the north-west of Wildbad; it is the terminus of a railway from Karlsruhe.

TEINACH (1,280 feet), about 8 miles to the south-east of Wildbad, is a pretty summer resort with facilities for hydrotherapeutic treatment and for milk and whey cures.* It has gaseous alkaline 'table waters.' The places mentioned above after Wildbad are all in Württemberg.

We shall now mention a group of health resorts situated near the **Kniebis Mountain** (3,165 feet), mostly in Baden.

RIPPOLDSAU (1,856 feet), the best known of the 'Kniebis spas,' lies in a narrow part of the Wolfthal, a typical thickly wooded

Black Forest valley, at the south-eastern base of the Kniebis. Its gaseous chalybeate waters contain small amounts of bicarbonate of calcium and sulphate of sodium. The other Kniebis spas, namely, GRIESBACH (1,850 feet), PETERSTHAL (1,330 feet), and FREIERSBACH (1,260 feet), in the Renchthal, and ANTOGAST (1,640 feet), in the beautiful Maisachthal, likewise possess gaseous alkaline earthy chalybeate springs, useful in anæmic conditions &c.

On the Württemberg side of the Kniebis is FREUDENSTADT, a favourite summer resort, situated near pine forests, on a plateau 2,380 feet above sea-level. It is much visited for an 'after-cure' to spa treatment.

Here we may conveniently mention IMNAU (1,140 feet), with gaseous chalybeate springs, pleasantly situated in the Eyachthal, in the west of the Principality of Hohenzollern.

OPPENAU (Baden), in a broad part of the Renchthal (910 feet), to the west of the Kniebis spas, is often used as a summer resort on account of the various excursions to be made in the neighbourhood; it is the terminus of a branch railway from Appenweier. ALLERHEILIGEN (2,035 feet), in a wooded valley, some distance to the north of Oppenau, may likewise be used as a summer resort by those contented with simple accommodation.

Dr. Walther's well-known sanatorium, **Nordrach-Colonie** (1,470 feet), has a sheltered position facing southwards amidst pine-clad hills, on which numerous sloping paths serve for the patients' exercise. It is $4\frac{1}{2}$ miles from the village of Nordrach, and 9 miles from the nearest railway station, Biberach-Zell. At NORDRACH itself sanatorium treatment is likewise carried out.

Triberg (2,250 feet), situated near the well-known waterfalls, with a station on the famous Black Forest railway, is greatly frequented as a summer resort, but is rather too much of an industrial town to be regarded as a health resort proper. The deep valleys and pine-clad slopes of the neighbourhood are typical of this most interesting district of the centre of the Black Forest. Three miles from the station of Triberg is SCHÖNWALD, a quiet summer resort at a higher elevation (3,260 feet). HORNBERG (1,260 feet), on the Black Forest railway, a few miles to the north of Triberg, attracts many summer visitors. There is likewise an hotel on the SCHLOSSBERG, about 240 feet above the railway and town.

The strong brine baths of DÜRRHEIM (2,300 feet), 3 miles to the east of the railway station of Marbach, may be conveniently mentioned here.

We come now to the localities in the southern portion of the Black Forest, that is, to the south of Freiburg.

Badenweiler (1,370 to 1,470 feet), beautifully situated on a spur of the north-western declivity of the Blauen, is sheltered on

the north, east, and south by pine-clad mountains. It is open towards the west, and in that direction commands a view across the Rhine Valley to the Vosges Mountains. Its simple subthermal springs (79° F.) were known from Roman times, as extensive remains of the Roman thermæ show. The modern swimming baths are excellent. The air is pure and of medium humidity, and the summer (mean temperature, 63·5° F.) relatively cool, though occasionally rather hot. Badenweiler is much used as a summer resort (there is also private sanatorium accommodation) by delicate persons with chronic catarrhal affections of the respiratory organs, chronic neuralgias, and irritable nervous disorders &c. It is an excellent place for milk and whey cures and for grape cures (autumn); and also for a stay after courses of active mineral waters at other spas ('Nachkur'). Owing to the variety of beautiful walks on the wooded slopes, it is well adapted for graduated walking and climbing exercise ('Terrain-Cur'). In the neighbourhood of Badenweiler are a number of localities at various elevations, which can be used as climatic resorts according to the time of year and the patient's constitution: NIEDERWEILER (970 feet) and OBERWEILER (1,115 feet), both in the little valley at the foot of the slope to the north of Badenweiler; HAUS BADEN (1,750 feet); SCHLOSS BÜRGELEN (2,180 feet); and even the inn on the summit of the BLAUEN (3,830 feet), for persons who are not fastidious and only require bracing air. To the east of the Blauen are the insurance company sanatoriums 'Friedrichsheim' and 'Luisenheim' for consumptives, probably the highest (2,775 feet) in Germany.

St. Blasien (2,530 feet) has a sheltered sunny position amidst the pines of the deep Upper Albthal, in the south-eastern part of the Black Forest. The climate is relatively mild and equable for spring and autumn residence, and there is much less mist than in the Rhine Valley. The place is likewise kept open during winter. The snow covering, according to Dr. Determann, lasts about 10 weeks, and at this season dry and sunny, though cold, weather generally prevails. The mean winter temperature is about 29·6° F. The air is pure and fresh, and the walks in the surrounding pine woods, which afford ample shade during the hottest summer months, can be used for graduated walking and climbing exercise, as at the so-called 'Terrainkurorte.' It is a good place for hydrotherapeutic and dietetic treatment, milk cures, &c. Many cases with 'nervous dyspepsia' would be specially suitable. There is an excellent well-situated sanatorium for the special treatment of consumptive patients.

Todtmoos, or more correctly VORDER-TODTMOOS (2,690 feet), rivals St. Blasien in its general climatic advantages and in its beautiful and sheltered position at the northern end of the romantic

Wehrathal, that is to say, at the point where the various Todtmoos valleys unite to form the Wehrathal. The hotel accommodation is fair, and the place can be reached through the Wehrathal in $2\frac{1}{2}$ hours from the railway station of Wehr. Close to Todtmoos is the magnificent WEHRAWALD SANATORIUM (2,820 feet), opened in 1901 for the special treatment of pulmonary tuberculosis. It stands on the southern slope of a spur, with its back to a pine forest and with its face towards the south, looking over the beautiful Valley of the Wehra. The construction and arrangements of the sanatorium are largely on lines planned out by Dr. Turban of Davos, a former assistant of whom is the present medical director.

The following summer resorts in the southern Black Forest must likewise be mentioned: TITISSEE (2,815 feet), with a station on the Höllenthal railway, and SCHLUCHSEE (3,120 feet), both of them near pretty lakes and pine forests; BAD BOLL (3,200 feet), near Bonndorf; and HÖCHENSCHWAND (3,310 feet), one of the highest villages in the Black Forest. The last place is cool and refreshing during summer (mean temperature for the three summer months only 55.4° F., according to Reimer), but, owing to its position on the top of a ridge, there is practically no shelter from winds. Still more bracing situations, but of course not suitable for invalids, are those of the inns at or near the summits of the Belchen (4,640 feet) and the Feldberg (4,900 feet), the latter the highest mountain of the whole Schwarzwald.

We may here allude to the university towns of **Freiburg-im-Breisgau** (920 feet), at the western foot of the Black Forest, and **Heidelberg** (365 to 640 feet), at the entrance of the Neckar Valley. These two towns of Baden vie with each other, and also with Baden-Baden, which lies midway between them, in the extreme beauty of their situations. Though not exactly health resorts, both towns are much resorted to by strangers, not only on account of their picturesque scenery and architectural attractions, but likewise on account of their educational facilities and the opportunities for medical advice and treatment they afford. Heidelberg has a slightly cooler summer and warmer winter than Freiburg. The Heidelberg hotels are of various elevations. Those near the station have an altitude of about 365 feet; those near the Schloss about 730 feet, while the KOHLHOF is 1,485 feet above sea-level. The last place has a fine airy position on the hills at the southern border of a forest, in which there are plenty of gently sloping paths suitable for a Terrain-Cur. It is $1\frac{1}{2}$ hours by carriage from Heidelberg. In a valley about 1 mile to the south of Freiburg is the private sanatorium of REBHAUS (1,000 feet) with arrangements for hydrotherapy and for the

treatment of patients with anæmia, chronic disorders of the digestive organs &c.

THE HARZ MOUNTAINS

The Harz Mountains (latitude $51^{\circ} 25'$ to $51^{\circ} 55'$ north), the most northerly of the principal mountain groups of Germany, are nearly isolated on every side. Owing to the more northerly latitude and isolated position of these mountains, the health resorts they contain mostly have far more bracing climates than have places in the Swiss Alps of equal elevation above sea-level. The summer resorts in the Harz are very popular amongst North Germans, and are generally crowded with visitors during the middle of the season. They are relatively but little visited by the English.

HARZBURG lies on the northern declivity of the Harz Mountains, at the entrance of the Radauthal. The railway station is about 800 feet above sea-level, but some portions of the health resort, including the brine baths of JULIUSHALL, are situated about 50 feet higher. On account of its beautiful situation, its shady walks, its easy access, and the numerous excursions to be made into the Harz Mountains, Harzburg is one of the most popular summer resorts in North Germany. On the summit of the BURGBERG (1,555 feet), above Harzburg, there is likewise limited accommodation.

ST. ANDREASBERG (1,665–2,165 feet above sea-level) has a sheltered position in the Upper Harz, and its bracing climate has a good reputation in scrofulous affections and supposed tendency to pulmonary tuberculosis. It is used as a winter as well as a summer resort. The mean temperature for the year is said to be 44° F.; spring, 42.6° ; summer, 58.8° ; autumn, 44.4° ; winter, 30.2° . Near St. Andreasberg two excellent sanatoria have been established by the Hanse Towns Insurance Company: the ODERBERG SANATORIUM (2,100 feet) for poor consumptive men, and the GLUCKAUF SANATORIUM for poor consumptive females.

On the northern declivity of the Ober-Harz (north-western portion of the Harz Mountains) we may mention ILSENBURG (780 feet) and WERNIGERODE (770 feet), which owe much of their popularity to the beautiful excursions which can be made in their neighbourhood. Higher up in the mountains are Braunlage (1,840 feet), Schiercke (1,850 feet), Clausthal (1,840 feet), and the hotels of Stoberhey (2,360 feet) and the summit of the Brocken (3,415 feet). BRAUNLAGE lies in a fairly sheltered valley, and is open to invalids throughout the year. SCHIERCKE, on the southern

declivity of the Brocken, has a quiet position in the midst of extensive pine forests, and is a cool resort for the summer months. CLAUSTHAL, an important mining place, is rather bleak and has a bracing climate, too rough for serious invalids. STÖBERHEI and the top of the BROCKEN are, owing to their exposed and windy positions, only suitable as very bracing summer resorts for healthy persons.

We now come to the resorts in the **Unter-Harz**, or south-eastern division of the Harz Mountains.

ALEXISBAD (1,080 feet), with chalybeate waters, is a sheltered and sequestered summer resort in the beautiful Selke Valley of the Lower Harz. The air is fresh and moderately moist, and there are charming walks in the neighbouring woods.

THALE (630 feet) is a summer resort at the northern foot of the Unter-Harz, at the entrance to the Bodethal, one of the most beautiful districts of the whole Harz Mountains. The HUBERTUSBAD at Thale, on a small island in the Bode, possesses muriated waters. Close to Thale are the heights of the ROSSTRAPPE (1,315 feet) and the HEXENTANZPLATZ (1,525 feet), but the hotels on these popular points of view are often crowded with excursionists, and, owing to the constant coming and going of tourists, are, like the top of the Brocken and the hotels on the Rigi and Pilatus in Switzerland, too noisy for persons to stay at who require rest.

Amongst other summer resorts on the northern side of the Unter-Harz are BLANKENBURG A. H. (750 feet), GERNRODE (730 feet), and BALLENSTEDT (690 feet). Close to Gernrode is SUDERODE (620 feet), with a rather weak brine.

FRANKENHAUSEN (370 feet), in a valley on the southern declivity of the Kyffhäuser, to the south of the Harz Mountains, possesses brine baths.

THE THURINGIAN FOREST (THÜRINGER WALD)

The Thuringian Mountains (latitude $50^{\circ} 30'$ to 51° north) are not quite so high and have a milder climate than the Harz Mountains. The summits are mostly covered with pine trees. The Thuringian summer resorts are very popular amongst Germans, especially the localities on the northern slopes.

Friedrichroda (1,320 to 1,430 feet) should be mentioned first, and is perhaps the most frequented summer climatic resort of the Thuringian Forest. It lies amidst extensive forests, in a valley of the northern declivity, about 10 miles to the south-west of Gotha. Mean temperature for the three summer months,

62·8° F.; for September, 59·4° F. Owing to the surrounding forests, the climate is relatively rather moist and equable. The mean relative humidity for the summer months is about 75 per cent. (considerably higher than that of neighbouring towns in the plain), and the daily range not more than 9° F. The surroundings are well adapted for graduated walking and climbing exercise. In the adjoining pine woods there are abundant pleasant walks, sheltered both from sun and wind, and the park of Schloss-Reinhardtsbrunn, only a short distance off, is open to the public. Friedrichroda is a good place for milk and whey cures.

TABARZ (1,300–1,370 feet), consisting of the three villages, Gross-Tabarz, Klein-Tabarz, and Kabarz (or Cabarz), is a summer resort with similar advantages. It lies about 2½ miles to the north-west of Friedrichroda, at the northern foot of the Inselsberg.

OBERHOF, the highest health resort of the Thuringian Forest, is situated in its centre, on a plateau about 2,625 feet above sea-level, not far from the Schneekopf (3,210 feet), and the Beerberg (3,240 feet), the highest summits of the Thuringian Mountains. To its open position and relatively high altitude Oberhof owes its bracing climate. Mean summer temperature, 56·5° F. Though the main roads are dusty, there are beautiful walks in the neighbouring woods, and we may mention the excursion to the beautifully situated 'SCHMÜCKE' (2,990 feet), partly by the Rennstieg, a most ancient boundary between Thuringia and Franconia.

RUHLA (1,595 feet), BROTTRODE (1,896 feet), and TAMBACH (1,480 feet) are summer resorts in the heart of the mountains.

ELGERSBURG (1,790 feet) and ILMENAU (1,565 feet), on the northern declivity, have well-known hydrotherapeutic establishments; one of the Elgersburg establishments was founded as early as 1837 by the self-taught Jakob Gräser.

On the northern declivity, rather further to the east, (the Thuringian) BLANKENBURG (738 feet), at the entrance of the romantic part of the Schwarzthal, and RUDOLSTADT (645 feet), the capital of the little Principality of Schwarzburg-Rudolstadt, are likewise used as summer resorts, although the heat is often great. Near Blankenburg is the Sanatorium Schwarzeck with arrangements for hydrotherapy &c. At Rudolstadt there is a private sanatorium for neurasthenia, digestive troubles, &c.

Eisenach (725 feet) is famous for its position at the foot of the Wartburg, in the north-western corner (one of the most beautiful parts) of the Thuringian Forest. Though rather hot for midsummer, the slopes around Eisenach offer well-situated hotels and villas, suitable for late summer and autumn residence. The HAINSTEIN Sanatorium for chronic diseases (1,020 feet), with arrangements for hydrotherapy &c., has a magnificent view

of the Wartburg. In regard to the muriated Karolinenquelle and the 'Sophienbad' at Eisenach see Part II, Chapter XVIII.

LIEBENSTEIN (1,450 feet), in Saxe-Meiningen, is well known amongst North Germans for its gaseous alkaline earthy chalybeate springs, and for its beautiful position in a well-wooded district of the south-western declivity of the Thuringian Forest, near Schloss Altenstein and the picturesque ruins of the Burg Stein. Liebenstein is sheltered on the north and east, and has a fairly equable climate of medium humidity.

SALZUNGEN (780 feet), in the broad Werrathal, at the south-western foot of the Thuringian Forest, not far from Liebenstein, has brine springs of various strengths, with arrangements for brine baths ('Soolbäder'). Inhalation treatment is much employed, both by ordinary pulverisation of the brine and by a large 'Gradirhaus,' which is kept up merely on account of the patients. There is an excellent sanatorium for scrofulous and weakly children of the poorer classes.

In the extreme south of Saxe-Meiningen is FRIEDRICHSHALL, with muriated sulphated 'bitter waters,' much exported for their laxative action.

ARNSTADT (920 feet), at the northern foot of the Thuringian Forest, and KOESTRITZ (550 feet), much further east, in the Elsterthal, have arrangements for brine baths; Koestritz is chiefly known for its hot sand baths, which were first employed there in 1865.

On the EMSKOPF, in the HARTH FOREST, not far from BERKA, is a modern popular sanatorium for pulmonary tuberculosis; it stands in the midst of a dense pine forest, in which level walks can be taken. There are likewise arrangements on the Harth for the treatment of paying patients.

We will now mention some health resorts in the '**Frankenwald**' (or Franconian Forest, a range which unites the south-western portion of the Thuringian Forest with the Fichtelgebirge), in the Fichtelgebirge, and in the '**Franconian Switzerland**,' as a northern portion of the Franconian Jura to the west of the Fichtelgebirge is called.

LOBENSTEIN (1,650 feet) is pleasantly situated on the southern declivity of the Thuringian Forest, at the commencement of the Frankenwald. Owing to the neighbouring woods the climate is rather moist. Mean summer temperature, 62.4° F. There are chalybeate springs, rather poor in free carbonic acid gas, and arrangements for ferruginous peat baths.

STEBEN, situated on the wooded plateau of the Frankenwald, at an altitude of about 1,950 feet above sea-level, has a decidedly

bracing summer climate. It possesses gaseous chalybeate springs and arrangements for peat baths. It is said to be the most elevated chalybeate spa in Germany.

BERNECK (1,280 feet) is a favourite summer resort, picturesquely situated in the narrow valley of the Oelsnitz, on the western declivity of the Fichtelgebirge. It is a place well suited for excursions into this mountain group.

ALEXANDERSBAD (1,915 feet) is a bracing resort in the Fichtelgebirge, close to the Luisenburg, possessing gaseous chalybeate waters and good arrangements for hydrotherapeutic treatment.

KÖNIG-OTTO-BAD (1,680 feet), named after the late King Otto of Greece, situated on the southern declivity of the Fichtelgebirge, not far from the railway station of Wiesau, has chalybeate waters and peat baths.

STREITBERG (1,910 feet) and MUGGENDORF (1,780 feet), $2\frac{1}{2}$ miles from each other, in the western part of the 'Franconian Switzerland,' are summer resorts with good arrangements for milk and whey cures. Chalky soil.

THE ERZGEBIRGE AND THE KINGDOM OF SAXONY

The **Erzgebirge** (latitude 50° to 51° north) is a range of mountains constituting the natural boundary between Bohemia and the Kingdom of Saxony, and having a north-easterly direction from Bavaria on the south-west towards Prussian Silesia on the north-east. The mountains attain a height of about 2,600 feet, and the highest summit (Keilberg in Bohemia) has an altitude of 4,080 feet. Situated on the declivities of these mountains are several health resorts of moderate elevation.

BAD-ELSTER, in the Elstergebirge, the western portion of the Erzgebirge, will for convenience be described later on together with Marienbad and the Bohemian spas. SCHOENECK (2,515 feet), to the north-east of Elster, may be used as a summer resort on account of its relatively elevated situation.

REIBOLDSGRÜN (2,270 feet), on the Saxon side of the Erzgebirge, not far from the railway station of Auerbach, is surrounded by an extensive pine forest, which helps greatly to shelter the place from winds, and also to make the temperature more equable and purify the air. According to meteorological observations taken at a rather higher level (Reimer), the mean temperature for summer is 57.8° F.; for autumn, 42.1° ; for winter, 27.8° ; for spring, 41.4° . Mean annual relative humidity, 83.8 per cent. Dr. Driver's private sanatorium for consumptive patients was founded in 1873.

REITZENHAIN (2,490 feet), a summer resort in the central portion of the Erzgebirge, on the border-line between Saxony and Bohemia, has a station on the railway which crosses the frontier at this point. WIESENBAD (1,480 feet) and WARMBAD or BAD-WOLKENSTEIN (1,500 feet), to the north-west of Reitzenhain, possess simple subthermal waters. In the portion of the Erzgebirge to the east of Reitzenhain are several pleasantly situated places which may be used as summer resorts by those who are not very fastidious.

In the so-called '**Saxon Switzerland**,' at the eastern end of the Erzgebirge, we may mention SCHANDAU (395 feet) and SCHWEIZERMÜHLE (1,150 feet) as summer resorts, the latter with a well-known hydrotherapeutic establishment; and in the neighbouring portion of Bohemia, BODENBACH (440 feet) and DITTERSBAACH (1,090 feet).

AUGUSTSBAD (720 feet), about 11 miles to the north-east of Dresden, in a sheltered position amidst beautiful pine woods, has arrangements for hydrotherapeutic treatment, milk and whey cures, &c. Its chalybeate waters are rather poor in free carbonic acid gas. THARANDT (685 feet), in a beautiful situation $8\frac{1}{2}$ miles to the south-west of Dresden, is a summer resort with good opportunities for milk and whey cures &c. Amongst other localities near Dresden is the WEISSER HIRSCH (780 feet), a popular summer resort about 3 miles to the east of the town, at the southern edge of the wooded plateau called the Dresdner Heide. It possesses sanatoriums for dietetic and open-air treatment, with arrangements for sun baths, hydrotherapy, &c.

We may here for convenience mention MUSKAU (320 feet), on the Neisse, in Prussian Silesia, with springs containing both bicarbonate and sulphate of iron. The bath establishment lies in the middle of a fine park, and has arrangements for ferruginous peat baths &c.

THE RIESENGBIRGE (GIANT MOUNTAINS) AND THE SUDETIC RANGE

The Isergebirge, the Riesengebirge, the Eulengebirge, Adlergebirge, Sudeten, &c., which are sometimes all included under the term '**Sudetic Mountains**' (latitude $49^{\circ} 40'$ to 51° north), form a chain of mountains occupying the north-eastern borders of Bohemia and Moravia with the adjacent parts of Silesia, and extending from the eastern end of the Erzgebirge towards the south-east as far as the sources of the Oder and the Carpathians. The Riesengebirge group, in the narrow sense of the term, reaches an average height of 4,300 feet, its highest summit (the

Schneekoppe) being 5,260 feet above sea-level. Forest trees cover the slopes for the most part to a height of about 3,500 feet. The summer resorts are apt to be excessively crowded with passing tourists.

FLINSBERG (1,720 feet) is a long stretched-out village in the picturesque Queisthal, at the northern foot of the Tafelfichte (3,690 feet), the highest point of the Isergebirge. It is a summer resort, with a rather moist forest climate, of medium altitude, and possesses gaseous chalybeate springs and arrangements for hydrotherapeutic treatment.

LIEBWERDA (1,420 feet), on the western declivity of the Tafelfichte, about 8 miles to the west of Flinsberg, and on the Bohemian side of the frontier, has gaseous chalybeate springs.

Amongst the summer resorts on the north or German side of the Riesengebirge proper we will mention: SCHREIBERHAU (the highest village of Silesia, 2,060 feet above sea-level); PETERSDORF (1,300 feet), HERMSDORF (1,310 feet), WARMBRUNN (1,130 feet, with simple thermal springs); SCHMIEDEBERG (1,470 feet), and KRUMMHÜBEL (1,750 feet, at the northern foot of the Schneekoppe), places at no great distance from each other.

On the southern side of the Riesengebirge are the Bohemian summer resorts, SPINDELMÜHL (2,660 feet) and JOHANNISBAD (2,070 feet); the latter has a simple thermal (tepid) spring and is a good place for milk and whey cures.

Near the Bohemian frontier, between the Riesengebirge and the Eulengebirge, is **Goerbersdorf** (1,840 feet), in a beautiful valley sheltered practically on all sides by high slopes covered with pines. At this small Silesian village, in 1854, Dr. Hermann Brehmer commenced his treatment of consumptive patients, and in 1859 began to establish his private sanatorium, the oldest institution of its kind, which was afterwards much enlarged. Besides Brehmer's original establishment Goerbersdorf can boast of Dr. Roempler's large sanatorium, opened in 1875, and a smaller sanatorium belonging to Dr. Weicker. There are likewise arrangements for the treatment of a large number of consumptive patients of the poorer classes on the 'colony' system. On the beautiful woodland slopes around Goerbersdorf there are paths affording ample opportunity for graduated up-hill walking exercise.

BAD-SALZBRUNN or OBERSALZBRUNN (1,320 feet), in a shallow valley of the northern outskirts of the Sudetic range, is the southern (upper) portion of the long straggling village of Salzbrunn, about 40 miles to the south-west of Breslau. Its cold gaseous alkaline waters are chiefly used for drinking, but there are likewise good arrangements for baths, douches &c. and

apparatus, as at Ems, for expiration into rarefied air and inspiration from air at increased pressure. The spa is much resorted to by patients with chronic catarrhal affections of the respiratory organs, including some cases of quiescent or chronic pulmonary tuberculosis without fever. Chronic disorders of the digestive and urinary organs, especially if connected with a gouty tendency, are likewise frequently treated. Salzbrunn is not much sheltered from the north, and has a decidedly bracing climate. It is a good place for milk and whey cures &c. Special attention is devoted to the purity of the milk supplied, and besides ordinary cow's milk, the milk of goats, asses, and sheep can be obtained, and likewise whey from cow's and goat's milk, and kephir. Whey mixed with mineral water (warm or cold) and whey or kephir mixed with an iron preparation (German, 'Eisenmolke,' 'Eisenkephyr') are much employed, the latter in anæmic cases. Amongst popular attractions in the neighbourhood is the romantic gorge known as the 'Furstensteiner Grund.' ALTWASSER, not far from Salzbrunn, was well known as a chalybeate spa up to the year 1869, but the springs were then damaged by coal-mining work.

We will now mention a number of little health resorts in the picturesque **district of Glatz** in the Sudetic Mountains, of which the lofty old stronghold of Glatz may be imagined to form the central point.

BAD-REINERZ (1,860 feet), 17 miles to the west of Glatz, is situated in a pleasant valley between the Heuscheuergebirge and the Adlergebirge. It possesses gaseous chalybeate springs and arrangements for baths, douches, &c. Good milk, whey, and kephir are provided. Its tonic climate, of moderate humidity (mean summer temperature, 60·8° F.), its shady walks and chalybeate waters make it a suitable summer resort in some cases of convalescence from acute diseases. It is much resorted to by patients with chronic or quiescent pulmonary tuberculosis without fever.

BAD-CUDOWA (1,310 feet) is about 9 miles to the north-west of Reinerz, near to the Bohemian frontier. It is situated at the side of a broad valley, to the south of a wooded slope connected with the Heuscheuergebirge, the main elevations of which lie to the east. Its gaseous alkaline chalybeate waters are employed internally and for gaseous baths. The Eugenquelle, richest in iron, contains likewise an appreciable amount of arsenic.

BAD-LANGENAU or NIEDERLANGENAU (1,170 feet), about 16 miles to the south of Glatz, a quiet little place pleasantly situated in the Valley of the Glatzer Neisse, possesses gaseous chalybeate waters. So also does ALT-HAIDE or ALT-HEIDE (1,310 feet),

between Glatz and Reinerz. The chalybeate waters of CHARLOTTENBRUNN (1,550 feet), about 28 miles to the north-west of Glatz, are rather poor in carbonic acid gas. Charlottenbrunn is a summer resort in a wooded valley sheltered from cold winds.

BAD-LANDECK (1,530 feet), 21 miles to the south-east of Glatz, is pleasantly situated in the Bielathal, to the west of the Schneegebirge. Its simple thermal waters (68° to 83·3° F.) contain minute quantities of sodium sulphide and sulphuretted hydrogen. Its baths, its mountainous position, and the affections treated have led to a rough comparison of Landeck with Saint-Sauveur in the Pyrenees. Mean temperature for summer, 60° F.; for autumn, 43·7° F. Mean summer relative humidity, about 77 per cent.

We now come to GRAEFENBERG-FREIWALDAU, in Austrian Silesia, a summer resort and well-known station for hydrotherapeutic treatment, where Vincent Priessnitz (1799-1851) founded his establishment in 1826. Graefenberg (2,070 feet) lies in the Sudeten proper, not far to the north of the Altvater (4,890 feet), the highest summit of the group. The various establishments are built on the slopes at the head of a small branch valley, facing south-east, sheltered from cold winds. On a ridge higher up are promenades with beautiful views, both towards Prussia on the north and in the direction of Moravia on the south. The walks in the woods are very fine. Freiwaldau lies in the valley at a much lower elevation (1,450 feet) and has a decidedly less tonic climate than Graefenberg.

JOHANNISBRUNN (1,320 feet), in Austrian Silesia not far from Troppau, has a sheltered position in the Mohrathal, amidst the pine-clad slopes of the Sudeten, or rather of offshoots of the Sudetic range. It possesses gaseous chalybeate springs. Not far from Teschen, in Austrian Silesia, are the iodide and bromide containing common salt waters of IODBAD DARKAU.

ULLERSDORF or GROSS-ULLERSDORF (1,240 feet), with weakly mineralised subthermal springs, is a summer resort in a Moravian valley at the southern foot of the Altvater.

For convenience we may here mention GOCZALKOWITZ (850 feet) and KÖNIGSDORFF-JASTRZEMB (870 feet), two places in the south of Prussian Silesia, with brine baths of local utility.

OTHER REGIONS OF GERMANY

OLDESLOE and SEGERBERG, in Schleswig-Holstein, have pleasantly situated establishments for brine baths &c.

PLÖN, situated between the Grosse and Kleine Plöner See, and GREMSMÜHLEN, on the Dieksee, may be mentioned as summer

resorts in the picturesque region known as the '**Holstein Switzerland.**'

BAD STUER, in Mecklenburg-Schwerin, lies on the Plauer See, and has sheltering wooded hills and arrangements for hydrotherapy &c.

EBERSWALDE, 28 miles to the north-east of Berlin, and **FREIENWALDE**, 12 miles from Eberswalde, are summer resorts for the people of Berlin in pleasant well-wooded districts. They both possess weak chalybeate waters. **POTSDAM**, near Berlin, may be used for a stay in summer, owing to its beautiful royal parks.

OEYNHAUSEN or **REHME-OEYNHAUSEN** (230 feet), in the north of Westphalia, lies on the Werre, in a shallow fertile valley, not far from Minden and the picturesque '**Porta Westphalica.**' It is chiefly used for its thermal gaseous muriated waters, analogous to those of Nauheim, but the '**Thermal-Soolbäder**' of Oeynhausen have obtained a special reputation in chronic affections of the nervous system, and are annually resorted to by numbers of patients suffering from *tabes dorsalis* and various organic nervous diseases, as well as by sufferers from muscular rheumatism, debility after acute diseases &c. The walks in the fresh air of the well-wooded Kurpark are very pleasant.

PYRMONT (420 feet), in the Principality of Waldeck, in the beautiful Valley of the Emmer, is famous for its cold gaseous alkaline earthy chalybeate springs, and has likewise excellent arrangements for brine baths and ferruginous peat baths. It is partially sheltered by the surrounding wooded hills, on the slopes of which there are numerous shady paths suited for graduated walking and climbing exercise. Up the Bomberg (1,010 feet) there is a funicular railway. The green avenues, Kurpark, pretty villas, and surrounding scenery give Pyrmont a very bright and cheerful appearance. The air is pure, and rather moist for this part of Germany. Mean summer temperature, 60·8° F. (Reimer). The chalybeate waters and brine baths cause the place to be resorted to by large numbers of patients (especially women) suffering from various conditions of *anæmia* and debility. It is much frequented as a summer resort by Hanoverian families, and was, like Spa in Belgium, amongst the earliest '**spas**' of the European continent to get a reputation in England. The living is not very expensive.

BAD DRIBURG (730 feet), in a pleasant valley of the south-eastern portion of the **Teutoburger Wald**, is a quieter chalybeate spa than Pyrmont. Besides its cold gaseous alkaline earthy chalybeate springs it provides sulphurous peat baths, for which a peat from the Saatz sulphur spring is employed.

LIPPSPRINGE (450 feet), near Paderborn in Westphalia, and not far from Driburg, lies on the plain about $3\frac{1}{2}$ miles to the south-west of the Teutoburger Wald. The weakly mineralised Arminiusquelle (70° F.) contains small quantities of calcium sulphate, sodium sulphate, bicarbonate of iron &c. together with a relatively large amount of nitrogen gas. Lippspringe is chiefly frequented as a summer resort for patients with chronic catarrhal and tuberculous affections of the lungs without fever. The rather moist, equable climate, and the internal employment of the Arminiusquelle doubtless help to relieve irritable bronchitic complications, whilst the open-air life tends to increase the appetite and promote nutrition. Mean summer temperature, about 62·4° F. The neighbouring INSELBAD is used as a private sanatorium for asthmatic and bronchitic disorders.

DETMOLD (440 feet), the little capital of Lippe-Detmold, on the north-eastern side of the Teutoburger Wald, not far from the colossal Arminius monument, may serve as a summer resort for families of this part of Germany. Twelve miles to the north-west of Detmold are the brine springs of SALZUFLEN (320 feet).

MEINBERG (660 feet), at the northern foot of the Teutoburger Wald, 6 miles to the south-east of Detmold, has cold earthy sulphurous waters and sulphurous mud baths (German, 'Schwefel-schlammbäder'). BAD-EILSEN (230 feet), near Bückeburg, and BAD-NENNDORF (230 feet), about 15 miles to the west of Hanover, have similar earthy sulphurous waters, but, like Meinberg, are probably best known for their mud baths. Nenndorf has likewise arrangements for brine baths, but a large recently erected establishment is devoted exclusively to mud baths. Here we may likewise mention BAD-BENTHEIM (290 feet), pleasantly situated amidst woods, near the town and castle of Bentheim, in the west of Hanover, close to the frontier of Holland. It has cold earthy sulphurous waters and sulphurous mud baths.

A few miles to the north-west of Nenndorf is BAD-REHBURG (330 feet), in a sheltered position amidst some beautifully wooded hills near the Steinhuder Meer, 25 miles from Hanover. This small health resort is chiefly frequented by persons with chronic tuberculous affections of the lungs. It contains two private sanatoria for paying patients, as well as the 'Bremer Heilstätte' and another one for patients of the poorer classes. Excellent goat's whey is provided. The climate is relatively moist and equable for this part of the European continent.

WILHELMSHÖHE (about 820 to 1,820 feet), near Cassel, on the eastern declivity of the Habichtswald, with a park and château, formerly the summer residence of the Electors of Hesse, forms a beautiful well-wooded locality for a summer stay, and offers

facilities for hydrotherapeutic treatment, milk cures, gentle climbing exercise &c. It is connected by steam tramway with Cassel.

Near Cassel, at OBERKAUFUNGEN, is a sanatorium for consumptive patients.

WILDUNGEN (980 feet), in the Principality of Waldeck, is situated in a picturesque hilly district about 23 miles to the south-west of Cassel. Mean summer temperature, 61.6° F. (Reimer). Pleasant shady walks in the neighbouring woods. The weakly mineralised cold gaseous alkaline earthy Georg-Victorquelle is probably the most employed of the Wildungen springs. The Helenenquelle, which rises in the neighbouring Helenenthal, and the Königsquelle, are cold gaseous muriated alkaline springs containing a little over 1 per mille of each of the three salts—calcium bicarbonate, magnesium bicarbonate, and common salt. All these three springs contain a certain amount of bicarbonate of iron, and at least one of the neighbouring springs (the Stahlquelle) contains enough to be termed strongly chalybeate. The Wildungen waters are chiefly used for drinking, but there are likewise arrangements for gaseous mineral water baths. The place is mainly resorted to by patients suffering from affections of the urinary organs, and has long acquired a reputation as a 'surgical spa' owing to the skilful surgical treatment carried out there for vesical calculus, urethral stricture &c.

SALZSCHLIRF (820 feet), in a valley of the north-eastern declivity of the **Vogelsberg**, not far from Fulda, possesses cold gaseous muriated waters, used, like those of Homburg and Kissingen, both for drinking and for bathing. The neighbouring village of GROSSENLÜDER has a slightly laxative water termed 'Hessisches Bitterwasser,' containing about 15 per mille common salt and rather more than 1 per mille magnesium sulphate, with much free carbonic acid gas. SALZHAUSEN (470 feet), near Nidda, at the southern foot of the Vogelsberg, has weak muriated waters which can be artificially strengthened for brine baths. SODEN-STOLZENBERG (1,040 feet), with brine baths, is a little place in the Kinzigthal between the outermost ridges of the Spessart, Rhöngebirge, and Vogelsgebirge. About 6 miles to the south is ORB (480 feet), with cold gaseous muriated waters used for baths. SODENTHAL (470 feet), in a sheltered well-wooded valley of the Spessart, 4 miles from Aschaffenburg, has a rather moist and equable woodland climate. Its cold muriated waters, containing small amounts of magnesium bromide and calcium sulphide, are used for drinking, baths, douches, &c.

LUDWIGSBAD-WIPFELD (715 feet), in the Main Valley to the south of Schweinfurt, has cold earthy sulphurous waters and sulphurous mud baths.

BRÜCKENAU (980 feet) is a quiet health resort in the north of Bavaria (Lower Franconia), beautifully situated at the south-western foot of the *Rhöngebirge*, amidst forests of beech and oak. It has cold gaseous weak chalybeate waters and arrangements for douches, ferruginous peat baths &c. Good milk and whey are provided.

BOCKLET (690 feet), to the south-east of the *Rhöngebirge*, in the well-wooded valley of the Franconian Saale, $4\frac{1}{2}$ miles to the north of Kissingen, has gaseous chalybeate waters containing a small amount of common salt.

KISSINGEN (650 feet), the most important mineral water health resort of Bavaria, is situated amidst the meadows and wooded slopes of the Valley of the Franconian Saale, to the south-east of the *Rhöngebirge*. Mean summer temperature, 62.8° F. Mean relative humidity, 74.7 per cent. Its cold gaseous muriated waters (Rakoczy and Pandur springs) may be grouped in the same class as the well-known springs of Homburg; in Part III of the present volume we shall refer again to the utility of these two health resorts in various chronic affections. The Maxbrunnen is weakly mineralised, and much used as a gaseous table water. The Salinen-Sprudel and the Schönborn-Sprudel, with about 1 per cent. common salt, are used for ordinary brine baths, wave baths, &c.; the latter of these springs is much the richer in carbonic acid gas, and well suited for effervescent baths after the Nauheim methods. For stronger brine baths 'Mutterlauge' may be added. Near the Salinen-Sprudel are Gradirhäuser, as at Kreuznach, Reichenhall &c. There are several private sanatoria at Kissingen for special dietetic and other treatment. There is likewise a sanatorium for weakly children.

Near the interesting mediæval town of Rothenburg-on-the-Tauber (1,400 feet), in Bavaria, is the modern sanatorium of WILDBAD-ROTHENBURG, in a picturesque position on the slope between the old town and the river Tauber. It has weak mineral waters, arrangements for hydrotherapy, excellent swimming baths, &c., and is suitable for a stay after active spa-treatment elsewhere.

In Würtemberg we have still to mention JAGSTFELD (450 feet), near Heilbronn, and the picturesque old town of HALL o 'SCHWÄBISCH HALL' (980 feet), on account of their brine baths. Other places in Würtemberg have already been alluded to under the heading 'Black Forest.'

RESORTS OF THE BAVARIAN HIGHLANDS

The Bavarian Highlands, which with the adjacent lakes lie between latitudes $47^{\circ} 20'$ and 48° north; constitute the northern

border of the Eastern Alps. They contain a number of pleasant summer resorts of low and medium elevations, and, like the adjoining (northern) portions of the Austrian Alps, are rich in picturesque lakes and in muriated mineral waters, which can be used for brine baths ('Soolbäder').

Reichenhall (1,570 feet) is situated on the Saalach, close to the Austrian frontier, in a fairly broad valley (latitude $47^{\circ} 43'$ north), sheltered by mountains towards the east, south, and west, but open towards the north-east in the direction of Freilassing. Winds from the north and north-east are, however, during the season at least, infrequent. Mean summer temperature, about 63° F. Mean summer relative humidity, 75.5 per cent. The summer climate is therefore rather moist, and there is a good deal of rain (17 rainy days in June). Mean autumn temperature, 54° F.

The arrangements for brine baths are very good, and artificial gaseous baths can likewise be provided in suitable cases. A diluted brine is sometimes employed for internal treatment, and excellent whey from goats' milk is likewise made use of. For inhalation of the finely pulverised brine there are 'Gradirwerke' and a salt-water fountain, as well as special inhalation rooms. Chronic catarrhal conditions of the respiratory organs and scrofulous affections are amongst the cases most frequently treated. Compressed air chambers, on which G. von Liebig has written much, are frequently used at Reichenhall in emphysematous and chronic bronchitic cases. The doctors are, of course, thoroughly familiar with the management of chronic pulmonary tuberculosis. The wooded slopes and beautiful surroundings are admirably adapted for graduated walking and climbing exercise ('Terrain-Cur') in disorders of the circulatory system &c. The season is from May to October.

Berchtesgaden is situated on the southern declivity of the Untersberg, 12 miles by railway to the south-east of Reichenhall. Mean temperature for the three summer months, 61.7° F.; for September, 55.4° F. It possesses a $26\frac{1}{2}$ per cent. brine, and arrangements for brine baths, peat baths, aromatic pine baths, and inhalation treatment. It is a capital place for milk cures. The altitude generally given is about 1,870 feet, but accommodation can be obtained in the scattered houses and hotels of the town itself and the neighbourhood at various levels between 1,650 and 3,300 feet (for instance, at Vordereck, 3,180 feet) above sea-level. The pure, fresh, moderately moist air, the beautiful scenery, and the interesting walks and excursions to be made (the salt mines, Salzburg, the Königssee, the Obersee, and, rather further off, the Steinerne Meer) cause Berchtesgaden to be visited

by crowds of tourists as well as by the invalids who frequent the place as a climatic summer resort for chronic affections of the respiratory organs, anæmic conditions &c.

The KÖNIGSSEE (1,975 feet), considered by some to be the most beautiful and picturesque lake in the Eastern Alps, can be reached by a drive of about 3 miles to the south of Berchtesgaden, but there is no regular accommodation for invalids. Many of the places on the various lakes of Upper Bavaria are good summer bathing resorts. We may mention TEGERNSEE (2,400 feet), SCHLIERSEE (2,580 feet), WALCHENSEE (2,640 feet), KOCHHEL (2,000 feet), BADERSEE (2,510 feet), and STARNBERG (1,920 feet), on the lakes of those names.¹

KREUTH or WILDBAD KREUTH (2,700 feet), in a sheltered position between the Tegernsee and the Achensee, is a summer resort of medium elevation, with a pure rather moist atmosphere and a good deal of rain. It is a good place for milk and whey cures.

KRANKENHEIL and TÖLZ are pleasantly situated on the Isar, at an elevation of about 2,150 feet above sea-level, 36½ miles by railway to the south of Munich. Bad Frankenheil possesses weakly mineralised muriated waters containing a little iodide of sodium.

HEILBRUNN (2,620 feet), a few miles to the west of Frankenheil, possesses the Adelheidsquelle, a muriated spring containing small amounts of bromide and iodide of sodium.

Amongst other summer resorts of the Bavarian Highlands we may mention: TRAUNSTEIN (1,960 feet), 22 miles by railway to the west of Salzburg, with brine baths and facilities for milk and whey cures.

PRIEN (1,740 feet), in the Prienthal, near the Chiemsee.

GARMISCH (2,290 feet), PARTENKIRCHEN (2,350 feet), KAINZENBAD (2,460 feet), and MITTENWALD (3,020 feet), the last place close to the Tirolese frontier.

BAD KOHLGRUB (2,950 feet), with chalybeate waters poor in carbonic acid gas, not far from Ober-Ammergau, noted for the survival of mediæval passion plays.

HOHENSCHWANGAU (2,650 feet), near the beautiful Alpsee and the romantic castles of Hohenschwangau and Neu-Schwanstein.

OBERSTDORF (2,680 feet), in a broad valley in the centre of the Algäu Alps, with beautiful walks in the neighbouring valleys, is a popular summer resort.

SULZBRUNN (2,680 feet), in the northern part of the Bavarian Algäu, possesses weakly mineralised muriated waters.

WÖRISHOFEN (1,870 feet), in Bavarian Swabia, has recently attained notoriety owing to the late Pfarrer Kneipp's treatment.

¹ The Lake of Starnberg is, however, as well or better known as the Würmsees.

AUSTRIA-HUNGARY. THE AUSTRIAN ALPS

For convenience in describing the health resorts of the Austrian-Hungarian Empire we shall consider the heading 'Austrian Alps' to include the portion of the Austrian dominions bounded by Italy, Switzerland, Bavaria, Bohemia, Moravia, Hungary, Croatia, and the Adriatic Sea. This region comprises Tirol, Salzburg, Upper and Lower Austria, Styria, Carinthia, Carniola, and the Austrian Coastland. It includes the greatest part of the so-called 'Eastern Alps,' of which we have already taken portions when describing the health resorts of Italy and of Upper Bavaria; the resorts in the Austrian Coastland, however, including Gorizia (Görtz), have been referred to under Mediterranean Climates in Chapter IV; Riva and Arco have been grouped with the Italian lakes in Chapter VIII; and the note on Bregenz has been added to the remarks on the other resorts of the Lake of Constance in Chapter VII.

TIROL

We shall commence with Meran and Botzen and the localities in their neighbourhood.

Meran lies in latitude $46^{\circ} 41'$ north, in a broad part of the Etsch (Adige) Valley, surrounded by high mountains on the north, north-east, and north-west. Immediately on the north rise the slopes of the Küchelberg in the angle between the Etsch and Passer Valleys. The shelter from cold winds is not complete, since north or north-easterly winds are to some extent admitted through the narrow Valley of the Passer, and north-west winds through the continuation upwards of the Etsch Valley. The place itself and its surroundings are beautiful and interesting, and its ancient importance is testified by the many old castles in its immediate neighbourhood, especially in the region of Obermais. The visitors' quarters, including OBERMAIS and UNTERMAIS (these two places form the southern suburbs of Meran, separated from it only by the Passer stream), have an elevation of 920 to 1,180 feet above sea-level, and consist chiefly of scattered villas and gardens. Mean temperature of Meran for autumn, 54° F.; for winter, 35.2° ; for spring, 54° ; for January, 32.6° ; for July, 67.6° . The mean annual relative humidity is said to be only 67.8 per cent., and the neighbourhood of the high roads may be unpleasantly dusty. Meran is an old-established autumn, winter, and spring resort. In summer the heat is very great, and the hotels are mostly closed. The winter is decidedly colder than that of the Western and Eastern Rivas, Venice, and

Abbazia, and even than the winter resorts of the Italian lakes and Gorizia (Görtz). The climate of Meran may be compared to that of Montreux, and these two places are almost equally popular resorts for the grape cure in autumn. The grapes of Meran are larger and have thinner skins and a more watery juice than those of Montreux. Meran is a good place for milk and whey. Although the mean temperature of Meran during winter is relatively low for a southern winter resort, the sun-warmth is great; and though the rainfall is considerable from September to December (11·7 inches), invalids can sit in the open air with ordinary precaution during about 70 days between the beginning of November and the end of March. There is less wind during winter than during summer. Snow, although it falls on about 7 days in the year, seldom remains long on the ground. There are facilities for hydrotherapeutic and inhalation treatment. The promenades and slopes around Meran are admirably adapted for graduated walking and climbing exercise—the so-called ‘Terrain-Cur.’ We may mention especially the attractive promenades on both banks of the Passer, with the pines and deciduous trees on the slopes of Obernais; the gently sloping zigzag path called the ‘Tappeiner Weg,’ constructed on the side of the Küchelberg; and lastly, amongst many longer excursions, the excellent road to the famous Schloss Tirol, the earliest residence of the Counts of Tirol, situated at an elevation of about 2,100 feet on the western declivity of the Küchelberg.

Botzen (880 feet), an important commercial town with quaint old-fashioned and more modern quarters, lies in a broad luxuriant expanse of the Etsch or Adige Valley called the ‘Botzen Boden,’ about 20 miles by railway to the south-east of Meran, amidst surroundings remarkable for their beautiful mountain scenery and the great number of picturesque old castles. Its winter temperature differs little from that of Meran, but as the sheltering mountains are further distant, it is more exposed to winds. It is therefore unsuitable as a winter resort, and too hot for summer residence,¹ but is a good place for the grape cure in autumn. The grapes are, of course, similar to those of Meran.

GRIES (906 feet), on the opposite or right side of the Talfer, the western suburb of Botzen, is a better resort for winter residence. It lies just under the mountains, and is therefore more sheltered from the north and north-east than Botzen; it is a sunny place, and partly, perhaps, owing to reflection from the cliffs, is warmer in the middle of the day than Botzen or Meran.

¹ Cooler sites near Botzen could be found on the plateau of the RITTEN, between the Talfer and the Eisak (for instance, near the village of KLOHNSTEIN, 3,770 feet above sea-level), or in the SARNTHAL, as the Valley of the Talfer is called above Botzen.

The dust is often disagreeable. The mean winter temperature is 34.7° F., that is practically the same as at Meran. There is at Gries a private sanatorium for consumptives. The place must not be confused with numerous other places of the same name, such as Gries on the Brenner route, mentioned later on.

In southern Tirol are several summer resorts with chalybeate waters, to which we shall now refer. RABBI or BAGNI DI RABBI (4,100 feet), the most frequented of these spas, lies in the Val-di-Rabbi, a branch of the Val-di-Sole (Valley of the Noce river), to the east of the Ortler group of mountains; it is chiefly visited from the end of June to the end of August. PEJO (4,430 feet), nearer to the Italian frontier, is situated to the south of the Ortler group, in the Pejo Valley, another branch of the Val-di-Sole; it is frequented by Italians and Tirolese. MITTERBAD (3,110 feet), 11 miles from Meran, and RATZES (3,900 feet), in a wooded ravine at the foot of the Schlern Mountain, have sulphate of iron waters; the latter has also a cold sulphur spring, but the accommodation is rather rough.

LEVICO (1,700 feet) and RONCEGNO (1,750 feet), to the east of Trent, are well known for their sulphate of iron and arsenic waters, which are largely exported. Levico lies at the entrance of the Val Sugana, $12\frac{1}{2}$ miles from Trent, and its mineral waters are obtained from near the bath-establishment of VETRIOLO, on the southern slope of Monte Fronte, nearly 4,900 feet above sea-level. The stronger of the Levico waters is said to contain in 1,000 parts 4.6 of sulphate of iron and 0.0086 of arsenious acid, together with small amounts of copper sulphate, zinc sulphate, aluminium sulphate &c. Roncigno is situated in the Val Sugana, $7\frac{1}{2}$ miles to the east of Levico. Both Levico and Roncigno have stations on the new Val Sugana railway, and can boast of modern hotel accommodation. During very hot weather, however, the lofty and more bracing position of Vetriolo is preferable in many cases. Here we may mention LAVARONE (3,840 feet), in the Val Centa, as a climatic summer resort about $7\frac{1}{2}$ miles from Caldonazzo, a station on the Val Sugana railway, not far from Levico.

The city of TRENT (Trient, Trento), though not a health resort, yet, owing to its historic importance, especially in ecclesiastical history, and owing to its beautiful situation in the Adige Valley (640 feet above sea-level), attracts persons on their way to and from health resorts, somewhat in the same manner as the still more attractive Innsbruck does.

The mountain valleys of Tirol contain many beautifully situated summer resorts, among which we will mention the following, mostly with altitudes above 3,500 feet:

SULDEN or ST. GERTRAUD (6,050 feet) and TRAFOI (5,080 feet), in northern valleys of the Ortler group, with excellent hotel accommodation.

CAMPIGLIO or MADONNA DI CAMPIGLIO (4,970 feet), 7 miles from Pinzolo, in a sheltered position to the north-east of the Adamello mountain group. It is an excellent high altitude and mountaineering summer resort, possessing first-class hotel accommodation, and fairly frequented by the English.

The MENDEL PASS (4,475 feet), to the south-west of Botzen.

The KARERSEE (5,580 feet), in the 'Fassa Dolomites,' 5 hours to the south-east of Botzen, with striking scenery and excellent hotel accommodation amidst woods. VIGO-DI-FASSA (4,560 feet), the chief village of the Fassa Valley.

SAN MARTINO-DI-CASTROZZA (4,800 feet), in the heart of the Dolomites, on a sheltered southern mountain slope, amidst woods, with beautiful views towards the south over the Primiero Valley.

LANDRO or HÖHLENSTEIN (4,600 feet), SCHLUDERBACH (4,730 feet), CORTINA-DI-AMPEZZO (4,025 feet), PEZZIE (quite close to Cortina, with the Hôtel Miramonte), and BORCA (2,980 feet, half-way between Cortina and Pieve-di-Cadore), in the region of the 'Ampezzo Dolomites.' All these places lie on the 'Ampezzo road,' which leads southwards from Toblach, in the Pusterthal, by Cortina and the beautiful Ampezzo Valley, to Pieve-di-Cadore and Belluno, in Italy. To the east of Monte Cristallo, and not far from Schluderbach, is the LAGO DI MISURINA, with modern hotel accommodation (Grand Hôtel Misurina), 5,760 feet above sea-level. About 2 hours from Schluderbach and 4 hours from Toblach is the DÜRRENSTEIN HOTEL (6,540 feet), on the Plätzwiese, to the south of the Dürrenstein Mountain.

BRUNECK (2,670 feet), NIEDERDORF (3,800 feet), TOBLACH (4,080 feet), and INNICHEN (3,850 feet), all in the Pusterthal. Toblach, at the entrance of the Ampezzo Valley, is the highest place of the Pusterthal. WILDBAD INNICHEN (4,370 feet) is situated amidst forests in a side valley not far from Innichen.

ALT-PRAGS (4,535 feet), NEU-PRAGS (4,320 feet), and PRAGSER WILDSEE (4,910 feet), in the beautiful Pragserthal, a branch of the Pusterthal.

SCHLOSS WEISSENSTEIN (3,410 feet), an ancient castle restored and converted into a hotel, beautifully situated near Windisch-Matrei, to the south-east of the Venediger mountain group. Here we will likewise mention HEILIGENBLUT (4,100 feet), in the neighbouring portion of Carinthia, to the south-east of the Grossglockner group.

BRENNER POST, at the summit of the Brenner Pass (4,490 feet), BRENNERBAD (4,390 feet), and GOSSENSASS (3,610 feet,

sometimes utilised by healthy persons for a winter holiday), with stations on the famous Brenner mountain railway, which was opened in 1867. The old Brenner Post Hotel lies on the Pass. The Brennerbad Hotel, a little to the south of the Pass, is in a slightly lower and more sheltered position. It is suitable as a bracing climatic resort for convalescents and for an 'after-cure' after spa treatment. Among other places on the same railway, GRIES (3,810 feet), STEINACH (3,430 feet), and STERZING (3,110 feet), said to be the highest town¹ in Tirol, may likewise be mentioned.

HINTER-TUX (4,900 feet), in the Tuxer Thal.

EGGERHOF (4,110 feet), beautifully situated above Meran.

SCHRÖCKEN or SCHRECKEN (4,135 feet), in Vorarlberg.

LANDECK (2,670 feet), in the Upper Inn Valley, well sheltered by mountains to the north, said to be suitable for a stay in winter because of much clear sunny weather.

LADIS (3,900 feet) and OBLADIS (4,550 feet), with sulphur waters, above the Inn Valley, not far from the railway station of Landeck.

OETZ (2,690 feet) and LÄNGENFELD (3,860 feet), the latter with sulphur waters, in the picturesque Oetzthal.

INNSBRUCK (1,870 to 1,910 feet), the capital of Tirol, is situated in latitude 47° 18' north, in a broad part of the Valley of the Inn, surrounded in almost every direction by mountains. The beauty of its position, its treasures of art and archæology, its excellent hotel accommodation, and the excursions to be made in its neighbourhood, all attract visitors and help to make the place a suitable autumn and winter resort for many persons who merely require change and recreation in a fairly clear and sunny climate.

HALL IN TIROL (1,835 feet), an old-fashioned town a few miles lower down the Inn Valley, is supplied with a strong brine from the Salzburg, used for brine baths ('Soolbäder').

IGLS (2,900 feet), on a plateau about 2½ miles to the south of Innsbruck, is a summer resort with magnificent views.

The ACHENSEE (3,045 feet) is one of the most attractive of the beautiful lakes of the Eastern Alps, and a good place for bathing. The temperature of its water reaches about 60° F. in the height of summer. There is fair accommodation on its banks.

As summer resorts in the north-eastern part of Tirol, for those who require only moderate bracing, we may likewise mention JENBACH (1,740 to 1,840 feet), BRIXLEGG (1,690 feet), and

¹ Many Tirolese villages, of course, are situated at much higher elevations than Sterzing. Those of OBERGUGL (6,265 feet) and VENT (6,250 feet), in the Oetzthal Alps, are said to be the highest villages in Austria.

KUFSTEIN (1,600 feet), in the Lower Inn Valley; ZELL-AM-ZILLER (1,885 feet), the chief place of the Zillerthal, specially famed amongst Tirolese valleys for the beauty of its scenery; KITZBÜHEL (2,420 feet) and WALCHSEE (2,190 feet), on the small lake of that name, not far from the Bavarian frontier. Close to Kufstein is KIENBERGKLAMM, with muriated waters and bath establishment.

SALZBURG, UPPER AND LOWER AUSTRIA, STYRIA, CARINTHIA,
AND CARNIOLA

SALZBURG (1,350 to 1,780 feet), capital of the Province of Salzburg, is situated on the Salzach in latitude $47^{\circ} 47'$ north. In its picturesqueness and historical and archæological interest it may be compared to Innsbruck, but the circle of sheltering mountains is much less complete, for to the north of Salzburg are only low hills, and to the west there is a level plain. The climate is typically continental, with hot summer and cold winter. Mean temperature for the year, 46.8° F.; for July, 65.2° F.; for January, 28.3° F. Mean annual rainfall, about 45.6 inches.

Ischl (1,550 feet), in the Salzkammergut, is beautifully situated in a broad fertile valley at the junction of the Traun and the Ischl. It is a fashionable health resort, very much resorted to by Austrians for its climate, its brine baths ('Soolbäder'), and its picturesque position. There are arrangements for brine baths, for salt mud baths, for inhalation of the pulverised water, and for ordinary hydrotherapeutic treatment. Owing to the shelter from winds afforded by the surrounding mountains the climate is mild, for some persons rather too hot during the middle of summer (mean summer temperature, 63.5° F.). In early autumn it may be used for a stay after a course of active mineral waters. It is a good place for milk and whey cures. The paths in the pine forests and on the surrounding slopes make the place suitable for a course of graduated walking and climbing exercise under medical supervision ('Terrain-Cur').

We must now mention several mild spring, summer, and autumn resorts (mostly of medium elevations) in this neighbourhood. Some of them are frequented for their brine baths and some for their open-air (lake) bathing, as well as for their climatic advantages and fine scenery. Many of them are situated on the shores of the beautiful mountain lakes for which the northern portions of the Austrian Alps, like the adjoining Bavarian Highlands, are famous.

GMUNDEN (1,390 feet), the chief town of the Salzkammergut, at the northern extremity of the Traunsee, with a strong brine

derived from the Ebensee salt works. **EBENSEE**, at the southern extremity of the Traunsee.

AUSSEE (2,150 feet), a popular summer resort with brine baths, lies in a broad fertile valley, surrounded by pine-clad mountain slopes and sheltered from winds on every side. The climate is mild and rather moist. Mean temperature for the three summer months, 61° F.; for May, 57·8° F. There is a sanatorium here ('Alpenheim') for hydrotherapy, brine baths, special dietetic treatment &c. Three miles from Aussee is the attractive Lake of **ALT-AUSSEE** (2,320 feet), with the summer resort Alt-Aussee.

HALLSTATT, on the western shore of the picturesque Lake of Hallstatt (1,620 feet), squeezed between the lake and the slope of the Plassen Mountain, has brine baths.

Other localities are: **MONDSEE** (1,575 feet), on the lake of that name; **ST. WOLFGANG** (1,820 feet), on the Aber-See or St. Wolfgang-See; and **KAMMER** and **UNTERACH**, on the Attersee. Between the three lakes just mentioned rises the isolated **SCHARBERG** (5,840 feet); the hotel on its summit, connected by a rack-and-pinion railway with St. Wolfgang, is of course not a place for the majority of invalids.

BAD HALL, in Upper Austria (1,230 feet), has a sheltered position in the Sulzbach branch of the Krems Valley, and possesses a muriated water (Tassilloquelle) containing small amounts of bromide and iodide of magnesium, formerly known as the 'Haller Kropfwasser.'

ZELL-AM-SEE (2,460 feet) is a small summer resort on the western shore of the Zeller See, a picturesque lake surrounded by mountains. Thermal springs arise in the lake, it is supposed, and in summer the temperature of the water often reaches 72° F. The bathing is good, and there are interesting excursions to be made in the neighbourhood. To the south, in the Kaprunerthal, higher accommodation may be obtained at the **KESSELFALL-ALPENHAUS** (3,460 feet), and also at the unpretentious **MOSER-BODEN** (**MOOSERBODEN**) hotel (6,430 feet), beautifully situated half-an-hour's walk from a large glacier.

Gastein or **WILDBAD-GASTEIN** (3,430 feet), famous for its simple thermal springs (78° to 121° F.), has a picturesque position on the mountain slopes at the southern extremity (the head) of the Gastein Valley, and is the terminus of a branch-railway from Schwarzach-St. Veit. The shelter from cold winds is very complete. Mean temperature for the three summer months, 57·2° F.; for May, 50·4°; for September, 51·8°. The summer climate is therefore relatively cool, but it is also rather moist. July and August, when the fashionable season is at its height, are especially rainy (there is rainfall on about 17 days in each of these months), whilst the colder spring and autumn months

have in this respect an advantage. For the indications for Gastein see Part II.

HOF-GASTEIN (2,850 feet), in a lower part of the valley, 5 miles to the north, is supplied with thermal water from Wildbad-Gastein, and is a somewhat less expensive place.

FUSCH or BAD ST. WOLFGANG (4,040 feet) is a much frequented summer resort to the north-east of the Gross-Glockner, in a sheltered side valley of the beautiful Fuschenthal. The cold springs, known from the fifteenth century, appear to be good ordinary water. There are arrangements for hydrotherapeutic treatment.

We will now pass to several resorts in Lower Austria situated in the **Wiener Wald** or its outskirts, and easily reached from Vienna. **BADEN-IN-AUSTRIA** (700 feet), pleasantly situated at the entrance of the Helenenthal, $16\frac{1}{2}$ miles by railway to the south-east of Vienna, is a popular summer resort of the Viennese, and possesses thermal earthy sulphur waters (80° to 96° F.) known already in Roman times. Arrangements for bathing in common are maintained at Baden, as they still are in the large piscinæ of Loèche in Switzerland, and of some French spas, and as they formerly were at Bath in England, and, as far as we can ascertain from old engravings, at most other thermal springs. There are likewise arrangements for separate thermal baths, mud baths, swimming baths, and ordinary hydrotherapeutic treatment. **VÖSLAU** (810 feet), $2\frac{1}{2}$ miles to the south of Baden, well known for its wines, has simple subthermal waters, with arrangements for hydrotherapeutic treatment. It is a good place for milk and whey cures, and in autumn for the grape cure. In a valley of the Wiener Wald, on a sheltered southern slope 10 miles to the west of Baden, stands the **ALLAND SANATORIUM** (1,410 feet) for consumptive patients of the poorer classes, in a beautiful and extensive estate of its own, consisting of woods, meadows, and cultivated land. The erection of this sanatorium was largely brought about by the exertions of Prof. L. von Schrötter, Dr. Conrad Clar, and Hofrath Christian Lippert. Between Baden and Vienna is **MÖDLING** (700 feet), a popular resort 10 miles from Vienna. **KALTENLEUTGEBEN** (1,150 feet), finely situated in a valley of the Wiener Wald in this neighbourhood, is well known owing to its hydrotherapeutic establishment under the direction of Professor Winternitz. Near Pernitz, in a sheltered situation, 1,800 feet above sea-level, is the 'Wienerwald Sanatorium' for consumptive patients. On the border of the Wiener Wald, just to the north of Vienna, is the **KAHLENBERG** (1,400 feet), which can be ascended by a rack-and-pinion railway, and is a favourite object of short excursions from Vienna.

The **Semmering**, separating Lower Austria from Styria, about half-way between Vienna and Gratz, is a favourite mountain resort of the Austrians. The Semmering Hotel (3,280 feet), on the slope of the Kartnerkogel, 1 mile from the station of Semmering (2,840 feet), stands about 60 feet higher than the highest point of the Semmering Pass. The Semmering is kept open during the winter as well as summer, but it cannot be termed a winter health resort for invalids. Amongst summer resorts of lower elevation on the Semmering railway are GLOGGNITZ (1,430 feet), on the Vienna side, where the line begins, SPITAL-AM-SEMMERING (2,520 feet), MÜRZZUSCHLAG (2,200 feet), and KRIEGLACH (1,970 feet).

GRATZ (1,160 to 1,230 feet), the capital of **Styria** and an industrial place, cannot be termed a climatic health resort proper, but, owing to its picturesque position, its healthiness, the moderate cost of living, and facilities for the education of children, it is frequently chosen as a place of residence by retired officers and civil servants. It is situated in 47° 4' latitude north, in the northern part of a broad expansion of the Valley of the Mur. Mean annual temperature, 48·6° F. As at Vienna and other continental places, there is a great range between the mean temperatures for the various months (January, 29° F.; July, 67·8° F.).

GLEICHENBERG (980 feet), in Styria, is situated to the south-east of Gratz, 7 miles from the railway station of Feldbach, not far from the Hungarian boundary. The hotels and villas of the health resort lie amidst pleasant woods and meadows in a valley open to the south-east and sheltered from north and north-west winds. Mean temperature for the three summer months, 63·2° F.; for September, 55·4° F. Mean summer relative humidity, about 75 per cent. Its cold gaseous muriated alkaline waters and its mild climate have caused Gleichenberg to be especially frequented (season, May to September) for chronic catarrhal affections of the respiratory organs. There is apparatus for inhalation of the mineral water spray, and there is likewise a chamber for compressed air treatment. Good milk and whey can be obtained. The health resort has a wide reputation in Austria-Hungary and South Germany.

TOBELBAD, DOBELBAD, or DOBBELBAD (1,090 feet), with simple subthermal waters, lies in a pleasant valley $7\frac{1}{2}$ miles to the south-east of Gratz, and is a good place for milk and whey cures. NEUHAUS (1,200 feet), TÜFFER (820 feet), and RÖMERBAD (800 feet), in the south of Styria, not far from Cilli, have simple thermal waters and beautiful positions, with pleasant walks in the neighbourhood. About 20 miles to the east of Cilli, in a beautiful

sheltered valley, is ROHITSCH-SAUERBRUNN (730 feet), with mild climate and cold gaseous springs. These waters are weak members of the sulphated alkaline group, and used in chronic dyspeptic conditions with constipation; some of them are exported and taken with the meals. RADEGUND (2,340 feet), about 10 miles to the north-east of Gratz, at the south-eastern foot of the Schöckel Mountain, has arrangements for hydrotherapeutic treatment &c. EIBESBERG (4,000 feet), not far from Weiz, in Styria, may be used as a climatic resort for a stay after mineral water treatment.

On the beautiful **Wörther See** (1,440 feet), in Carinthia, VELDEN, at the west end, and PÖRTSCHACH, on the northern shore, may be mentioned as summer resorts with bathing arrangements. Some places on the neighbouring OSSIACHER SEE (1,600 feet) can likewise be used for a summer stay.

VELDES (1,560 feet), in a fine position on the Lake of Veldes, in the northern part of Carniola, possesses a simple subthermal spring, but is better known as a summer resort where treatment by 'sun baths' and hydrotherapy can be obtained. The charming little WOCHENER SEE (1,730 feet), to the south-west of Veldes, likewise offers simple summer accommodation. ADELSBERG (1,800 feet) in the south of Carniola, famous for its immense cavern, is used as a summer resort by inhabitants of Trieste, from which it is about 50 miles by railway.

THE HEALTH RESORTS OF BOHEMIA AND MORAVIA

The three great Bohemian spas, Carlsbad, Marienbad, and Franzensbad, are situated in the north-western corner (Eger district) of Bohemia. With them we shall for convenience describe the Saxon spa, Bad Elster, both on account of its proximity to Bohemia and on account of the resemblance of its mineral waters to those of the famous Bohemian health resorts.

CARLSBAD or KARLSBAD (altitude about 1,230 feet) is a long narrow town stretching upwards in the narrow Valley of the Tepl, on both sides of the stream, from its entrance into the Eger for about two miles in a southward direction. The houses in the streets bordering the Tepl are somewhat cramped, but there are hotels and pensions on the slopes of the Schlossberg &c. which have a more open position. Mean temperature for the three summer months, about 58·6° F. In the pine woods on the sides of the valley are numerous shady walks for hot weather.

The thermal sulphated alkaline springs differ from each other chiefly in temperature and proportion of carbonic acid gas. They contain about 2·4 per mille sodium sulphate, 1·2 per mille sodium

bicarbonate, and 1.0 per mille common salt. The Carlsbad treatment consists chiefly in the internal use of the water and appropriate regulation of diet, exercise, and habits to suit individual cases. In the fine modern bath establishment there are arrangements for ordinary and mineral water baths, peat baths (as at Franzensbad), douches, hot-air and vapour baths, massage, and Swedish gymnastics.

MARIENBAD (2,090 feet) lies in a fairly broad valley, surrounded on all sides, except the south, by beautiful pine-clad slopes on which shady walks may be taken in different directions. The climate is more Alpine in character than that of Carlsbad, and the Marienbad springs offer greater variety in regard to their mineralisation than do those of Carlsbad. The Kreuzbrunnen and the Ferdinandsbrunnen resemble the springs of Carlsbad, but are cold and more highly mineralised; the new Alfredsquelle belongs to the same class, though somewhat less mineralised; the Waldquelle and Alexandrinenquelle contain much less sodium sulphate; the Rudolfsquelle is a cold alkaline earthy spring, comparable to the Helenenquelle at Wildungen; whilst the Karolinenbrunnen and the Ambrosiusbrunnen are chalybeate, the latter being one of the richest in bicarbonate of iron. Thus Marienbad has mineral waters suitable in various conditions besides those for which sulphated alkaline waters are usually recommended. There are good arrangements for effervescent baths, peat baths, hot-air and vapour baths, and for ordinary hydrotherapeutic treatment.

FRANZENSBAD (1,500 feet) is situated on a somewhat flat, elevated plateau, and the surrounding scenery is much less picturesque than that of Marienbad and Carlsbad. Its cold sulphated alkaline springs contain various amounts of bicarbonate of iron; the Salzquelle, with the least iron, most nearly resembles the Carlsbad springs, and this resemblance can be strengthened by warming the water; the Stahlquelle is strongly chalybeate. The bath arrangements are satisfactory. It is by its 'Moorbäder' or peat baths that Franzensbad has chiefly gained its notoriety, and the peat used for the baths is derived from moorlands immediately adjoining the town. The great majority of the patients treated at Franzensbad belong to the female sex.

BAD ELSTER (1,550 feet), in the Upper Vogtland of the Kingdom of Saxony, is close to the Bohemian frontier, and may conveniently be mentioned in this place. It is situated in the pleasant Valley of the Weisse Elster, and has a rather bracing climate. The Salzquelle is comparable to the Kreuzbrunnen and Ferdinandsbrunnen of Marienbad, and is employed in the same class of cases. The Marienquelle, which may be termed a com-

pound chalybeate spring, contains sodium sulphate, sodium bicarbonate, and common salt, and resembles the chalybeate springs of Franzensbad. There are arrangements for effervescent mineral water baths, ferruginous peat baths, &c. Whey and kephir are likewise to be obtained.

The season at these health resorts lasts from May to the end of September, but Carlsbad is likewise available at other times of the year. Tarasp, in Switzerland, also famous for its sulphated alkaline waters, has a higher altitude and a shorter season. The indications for this group of spas will be considered in the various sections of Part III and in Chapter XXI. A stay at some suitable climatic resort should always be recommended after the mineral water treatment ('after-cure,' German 'Nachkur'); patients should be cautioned against immediately resuming their ordinary work, and likewise against the risk of fatigue from shooting parties, climbing excursions &c. The choice of a health resort for the after-cure must depend on individual conditions.

TEPLITZ or TEPLITZ-SCHÖNAU (730 feet), in the north of Bohemia, about 30 miles south of Dresden, is situated in the broad Bielathal, sheltered by the Erzgebirge on the north and by the Bohemian Mittelgebirge on the south. Its simple thermal springs (83°-114° F.) belong to the longest and best known examples of their class, but the town has attained considerable industrial importance, which somewhat tends to modify its character as a health resort. In a gorge of the southern declivity of the Erzgebirge, 3½ miles to the north-west of Teplitz, is the summer resort of EICHWALD (1,180 feet).

Near Teplitz is BILIN with its well-known cold gaseous alkaline spring ('Biliner Sauerbrunn'); and between Teplitz and Carlsbad are the sources of the laxative sulphated 'bitter waters' (containing magnesium sulphate or 'Epsom salts'), PÜLLNA, SAIDSCHITZ, and SEDLITZ. The 'Sedlitz powders' of apothecaries contain tartaric acid, and imitate only by their name the salts of the mineral water. Near Carlsbad are the springs of GRÜSSHÜBL and KRONDORF, yielding gaseous weakly alkaline table waters, which are much exported.

BAD-KOENIGSWART (2,230 feet), situated amidst woods on a southern mountain slope between Marienbad and Eger, possesses cold gaseous chalybeate waters.

BAD-LUHATSCHOWITZ (1,600 feet), in the eastern part of Moravia, near the Hungarian frontier, lies in a sheltered wooded valley of the northern declivity of the Western Carpathians. The summer climate is rather moist and relatively cool. Mean summer temperature, 59° F. (Reimer). The season is from the middle of May to the end of September. Luhatschowitz

possesses gaseous muriated alkaline springs (containing small quantities of iodides and bromides), which differ from the better known ones of Ems in being cold instead of warm. The Luhatschowitz waters are useful in catarrhal affections of the respiratory and digestive systems in gouty subjects, and help to check the tendency to uric acid gravel.

The health resorts of Austrian Silesia and the Bohemian resorts in the Riesengebirge have been for convenience grouped with those on the German side of the frontier.

THE CARPATHIAN MOUNTAINS, AND HEALTH RESORTS OF GALICIA, HUNGARY, TRANSYLVANIA, SLAVONIA, CROATIA, AND BOSNIA

The Carpathian Mountains (including the Western, Central, Eastern, and Transylvanian or Southern groups) form a sort of semicircle (between latitudes 45° and 50° north) separating Hungary and Transylvania from Moravia, Galicia, and Roumania. The main chain stretches in a south-easterly direction from the eastern corner of Moravia to the south-eastern corner of Transylvania, and then curves round Transylvania to the west; this southern portion being termed the 'Transylvanian Alps' or Southern Carpathians. The north-eastern slopes towards Galicia and Roumania are much more precipitous than the south-western slopes towards the plain of Hungary. The High Tatra Mountains ('Hohe Tatra'), a group of the Central Carpathians, possess the highest peaks, reaching to over 8,000 feet above sea-level, and boast likewise of particularly grand and picturesque scenery. Though there are no glaciers in the Carpathians, some of the gorges, especially on the northern side, are always filled with snow. Trees cover the slopes, for the most part, to heights of 3,000-4,000 feet. The picturesque regions of the Carpathians are being made more accessible to tourists, whilst the accommodation and other arrangements at the health resorts and ordinary summer resorts are gradually improving.

SCHMECKS (Hungarian, TATRA-FÜRED) is the collective name of three health resorts in the Hungarian comitat Zips, on the southern declivity of the **High Tatra**. ALT-SCHMECKS, in a well-sheltered position, at an elevation of 3,320 feet above sea-level, has weakly mineralised gaseous waters with facilities for hydrotherapeutic treatment. NEU-SCHMECKS (3,300 feet), situated about half a mile to the west, in the midst of pines, is a climatic resort, open during the winter as well as during the summer. Mean temperature (Chyzer) for summer, 59·7° F.; for autumn, 44·1°; for winter, 25·9°; for spring, 41·5°; for the year, 43·2°; for January, 24·1°; for July, 61·2°. Mean annual relative

humidity, 76·8 per cent. There are many more bright days during winter than cloudy ones. There are arrangements for hydrotherapy and for the modern treatment of pulmonary tuberculosis. *UNTER-SCHMECKS* (3,080 feet), $1\frac{1}{4}$ miles below *Alt-Schmecks*, has ferruginous peat baths, effervescent mineral water baths, and a hydrotherapeutic establishment. These three health resorts are good places for graduated climbing exercise ('*Terrain-Cur*') after *Oertel's* methods.¹

TATRA-HÖHLENHAIN or *TATRA-BARLANGLIGET* (2,510 feet), in the *Kotlina Valley*, about 6 miles to the north-east of *Schmecks*, *TATRAHAZA* (2,280 feet), in the *Weisswasserthal*, and *ZAKOPANE* (2,730 feet), are summer resorts in this neighbourhood. *Zakopane*, situated on a plain in view of the *Galician Tatra* peaks, is likewise a winter resort for consumptives. It possesses hydrotherapeutic establishments and a sanatorium for tuberculosis. In the *High Tatra*, to the west of *Schmecks*, is the beautiful *CSORBA LAKE* (4,430 feet), the houses on the banks of which constitute the highest summer resort in Hungary. Near *POPRADE* (2,218 feet), the railway-station for *Schmecks*, is *HUSS-PARK*, with facilities for hydrotherapy.

Here we may mention : *BARTFELD* (1,000 feet), at the southern foot of the *Carpathians*, in the Hungarian comitat *Saros*, with cold gaseous muriated alkaline chalybeate waters ; *SZCZAWNICA* ² (1,700 feet) and *KRYNICA* (2,000 feet), both on the *Galician* side of the *Carpathians*, the former with cold gaseous muriated alkaline waters, the latter with cold gaseous alkaline earthy chalybeate springs. *IVONICZ* (1,340 feet), likewise on the *Galician* side, with muriated waters containing small quantities of iodides and bromides ; *SZOBORANZ* (425 feet), on the *Hungarian* side, in the comitat *Ung*, with cold muriated sulphur springs.

In the *Transylvanian* part of the *Carpathians* are the spas *BORSZEK* (2,890 feet) and *ELÖPATAK* or *ARAPATAK* (2,030 feet), with cold gaseous alkaline earthy chalybeate waters.

HERCULESBAD (570 feet), near *MEHADIA*, one of the most frequented and finest spas of Hungary, is situated in a picturesque valley of the offshoots of the *Carpathians*, close to the *Roumanian* and *Servian* frontiers, and not far to the north of the *Iron Gates* of the *Danube*. Its thermal muriated springs (70°–133° F.), mostly containing sulphuretted hydrogen, were known to the *Romans* (*Thermæ Herculis*). They are analogous to the springs of *Aachen* (*Aix-la-Chapelle*), in *Germany*, and are much frequented for similar affections, especially by the people of *South-eastern Europe*. The season is *May* to the end of *September*.

¹ In the *Hungarian* name *Tatra-Füred*, *Füred* (like the termination *fürdő* in *Rajeczfürdő*) corresponds to the *German* 'Bad,' the *Slavonic* 'Teplitz,' and the word (as used in *England*) 'Spa.'

² Mean temperature for the three summer months is given as 60·4° F.

Here may be mentioned the summer resort of MARILLA (2,290 feet), with facilities for hydrotherapy &c. and a sanatorium for tuberculosis. Marilla is beautifully situated in Southern Hungary, amidst mountains and grand pine forests. The mean temperature for May is said to be 59° F., for June 60·8°, for July and August 64·4°, and for September 60·8°.

Scattered about amongst the Carpathian ranges, which occupy a great portion of Northern Hungary, are a number of mineral water health resorts. We will mention Parad, Koritnicza, Szkleno, Szliacs, Vihnye, Rajeczfürdő, Trencsin-Teplitz, and Pystjan.

PARAD (660 feet), on the northern declivity of the Matra Mountains, to the north-east of Buda-Pest, possesses sulphate of iron and sulphurous springs.

KORITNICZA or KORYTNICZA (2,790 feet) is a summer resort in a pine-clad valley of the Lower Tatra, and possesses cold gaseous chalybeate waters containing small quantities of magnesium sulphate, calcium bicarbonate, and calcium sulphate. There are arrangements for hydrotherapeutic treatment and for whey cures.

SZKLENO (1,230 feet), in a deep thickly wooded valley, not far from Schemnitz, has thermal sulphate of calcium waters resembling those of Loèche-les-Bains, in Switzerland, and a natural vapour bath analogous to the grotto of Monsummano, in Italy.

SZLIACS (1,280 feet), near Altsohl, and VIHNYE (1,015 feet), not far from Schemnitz, are distinguished by their thermal gaseous alkaline earthy chalybeate waters. The temperatures of these springs range from 77° F. to 101° F.; that of the old spring of Vihnye being the hottest.

RAJECZFÜRDÖ or RAJECZ-TEPLITZ (1,374 feet), in the Sillinka Valley, not far from Sillein, has tepid weakly mineralised springs, containing minute quantities of alum.

TRENCSIN-TEPLITZ (850 feet), beautifully situated in a branch of the Waag Valley, has thermal sulphurous waters (99°–104° F.), and is, like the following spa, well known in Austria-Hungary.

The baths of PISTYAN or PÖSTYEN-TEPLITZ (490 feet), situated in the Waag Valley to the south of Trencsin, are supplied with thermal sulphurous waters (135°–146° F.). Hot sulphurous mud baths, both general and local, are very much employed, for which abundance of a fine mud, described as 'butter-like,' is obtained from about the thermal springs.

BUDA-PEST, the capital of Hungary, possesses simple thermal and thermal sulphurous waters, with commodious thermal establishments. Amongst these the MARGARETHENBAD, on the Margarethenbad-Insel in the Danube, and the large KAISERBAD deserve specially to be mentioned on account of the excellence of

their arrangements. The climate of Buda-Pest will be referred to in Chapter XI under the 'Large Towns of Europe.' The sulphated 'bitter waters' from the neighbourhood, including the HUNYADI JANOS, FRANZ-JOSEF, ÆSCULAP, and APENTA waters, are largely exported on account of their laxative properties. Near Buda-Pest is the Queen Elizabeth Sanatorium for tuberculosis, in a sheltered position amidst fine woods.

On the north-western shore of the large PLATTENSEE or BALATON LAKE (425 feet above sea-level) is the frequented summer health resort of FÜRED or BALATON-FÜRED, with gaseous weakly mineralised springs. The temperature of the lake in summer is 68° to 80·6° F. and it contains a relatively large amount of carbonic acid gas; bathing in the lake is much adopted as a means of treatment. The mud from the banks of the lake is used for mud baths, often in combination with rubbing. Good whey is provided at this health resort, and in autumn the grape cure can be carried out. (See also Part II, Chapter XXVII).

HARKANY (300 feet), in the south-west of Hungary, in the comitat Baranya, has thermal sulphurous waters (145° F.), in which Karl von Than in the year 1867 discovered the inflammable gas, carbonyl sulphide, said to be present over the spring in quantities sufficient to be ignited.

LIPIK (500 feet), in a sheltered valley of Slavonia, has weakly mineralised muriated alkaline waters (147° F.) containing small quantities of iodides; and DARUVAR (320 feet), to the north of Lipik, possesses simple thermal springs (104°-117° F.).

In Croatia we may mention WARASDIN-TEPLITZ (900 feet), with thermal sulphur springs (about 136° F.) and mud baths; KRAPINA-TEPLITZ (530 feet), with simple thermal waters (100°-110° F.); and TOPUSKO (410 feet), with simple thermal waters (122°-135° F.) and mud baths.

Bosnia and Herzegovina, now under Austrian administration, possess at least one fairly well known health resort, and by the variety of their mountainous scenery will doubtless by-and-by attract many travellers.¹ SARAJEVO (1,770 feet above sea-level), the capital of Bosnia, lies in latitude 43° 54' north, and has a continental type of climate. Mean annual temperature, 50° F.; mean January temperature, 29·1° F.; mean July temperature, 67·4° F.; mean annual rainfall, 31·5 inches. •

MOSTAR (195 to 350 feet above sea-level), the capital of Herzegovina, 47 miles south-west of Sarajevo, in latitude 43° 24' north, has a less elevated position nearer the coast, with a warmer climate (mean annual temperature said to be 56·8° F.) and more rain (annual rainfall, 44·1 inches). ILIDZE, a health resort

¹ See Pojmann, in *Wiener med. Wochenschrift*, 1900, No. 27.

beautifully situated at an altitude of about 1,600 feet, 8 miles from Sarajevo, possesses thermal sulphurous waters (124° F.) with an old reputation in the treatment of rheumatoid arthritis.

ROUMANIA AND BULGARIA

Roumania possesses several mineral water health resorts, and some of its springs were doubtless known to the Romans.¹ Amongst the muriated waters are the lakes of BALTA-ALBA and LACUL-SARAT, where salt mud baths are employed as at some places in Russia; MONTEOR-SARATA; SLANIC; and VULCAN. STRUNGA and CACIULATA possess sulphurous and other mineral waters. CAMPU-LUNGU is a summer resort at the foot of the Carpathians, close to which are the muriated waters of BUGHEA. DORNA-SCHARU, at an altitude of 3,600 feet, possesses arsenical waters. SINAÏA, the summer resort of the Roumanian Court, is beautifully situated amidst parks and pine woods, at an altitude of 2,620 feet, in a picturesque portion of the Carpathian Mountains, not far from the Transylvanian frontier; there is a good hydrotherapeutic establishment. CONSTANZA, the Roumanian port on the Black Sea, is frequented as a seaside summer resort. Close to Constanza, on a tongue of land between the Black Sea and the salt lake of TIGHIR-GHIOL, the administration of the hospitals of Bucharest have founded a sanatorium for scrofulous children. According to Dr. Berger, the same administration was to erect a sanatorium for consumptives on MOUNT TIGVELE, in the district of Gorju, in a sheltered position, at an elevation of 3,600 feet above sea-level.

Bulgaria² has several mineral water resorts. At MERITCH-LERY, a village 9 miles from Tchirpan, in Southern Bulgaria, there is a sulphated alkaline spring (72·9° F.), which, according to the analysis (1899) by Professor E. Hintz, contains 2·2 per mille sodium sulphate, 2·2 sodium bicarbonate, 1·1 sodium chloride, and a moderate amount of free carbonic acid gas. Near SLIVNO, at the southern declivity of the Balkan Mountains, there are thermal sulphurous waters (104° F.). About 6 miles from Karlovo in Southern Bulgaria are the baths of HISSAR, with simple thermal springs (96·8°-116·6° F.). The baths of KARLOVO, with thermal

¹ See Dr. M. S. D. Berger, *Les Eaux Minérales en Roumanie*. Paris, 1900. A. Schaabner's elaborate work on the *Mineral Waters and Climatic Resorts of Roumania* (second edition, published at Bucharest in 1906) should be consulted on the subject of Roumanian localities by all those who are more fortunate than the authors in being able to understand the Roumanian language.

² See 'Kurorte und Mineralquellen in Bulgarien,' by Dr. S. Wateff, of Sofia, *Deutsche medicinische Wochenschrift*, 1901, No. 4, page 58.

sulphurous waters (113° F.), are only about 3 miles from the town of Karlovo. **SOFIA** (latitude 42° 43' north), the capital of Bulgaria, possesses a thermal sulphurous spring (116·6° F.) used to supply a swimming bath which dates from Roman times. In the neighbourhood of Sofia there are several simple thermal baths: **PANCEREVO** (116·6° F.), in beautiful scenery on the banks of the River Iskar; **BANKY** (96·8° F.); **KUJAZEVO** (89·6° F.); **GORNA-BANJA** (104° F.). There are some beautiful and sheltered sites on the slopes of the Balkan, Rilo, and other mountain ranges of Bulgaria. These could be used for climatic purposes. At **TCHAM-KORYA**, on the northern declivity of the Rilo Mountains, near the town of Samakov, there is a sanatorium for tuberculous patients, but it is open in the summer only; there are likewise private houses and a hotel for summer visitors. **VARNA**, on the Black Sea, in Northern Bulgaria, is used as a summer and autumn resort for sea bathing and for the grape cure. At **BURGHAS**, in Southern Bulgaria, there are salt lakes near the coast, and arrangements for mud baths, similar to those at Odessa and other places on the Russian Black Sea coast.

In the rest of the Balkan Peninsula, in the mountainous districts of **Servia**, **Montenegro**, **Albania**, and **Greece**, there are some health resorts, which at present, however, are of local importance only.

THE CAUCASUS AND INLAND RUSSIA

Russia possesses a group of health resorts in the Caucasus, which are best known for their mineral waters. The chief of these spas, and the most important town of the district, is **PIATIGORSK** or **PYATIGORSK**, situated just north of latitude 44° north and just east of longitude 43° east. It lies at an altitude of about 1,685 feet on the south-western slope of the Mashuka Hill, facing the snow-topped mountains of the main Caucasus ridge, with their chief peak of **Elbruz** reaching to more than 18,000 feet above sea-level. The mean annual temperature is 48° F. The summer is hot (mean July temperature, 72° F.) and the winter cold (mean January temperature, 24° F.). According to Dr. F. G. Clemow,¹ visitors begin to leave the town at the end of August, though the official season lasts to the end of September. The annual rainfall is 21·3 inches, chiefly in early spring and late summer. The thermal muriated sulphurous waters (85°–116° F.) are employed in neuralgias, muscular rheumatism, syphilis &c.

¹ *The Medicinal Waters and Muds of Russia*, 1897.

JELEZNOVODSK (1,890 to 2,100 feet) is situated amidst pine forests on the Jeleznui Hill, about 8 miles from Piatigorsk. The summer is somewhat cooler than at the latter spa. The thermal chalybeate waters may perhaps be compared to those of Lamalou in France.

ESSENTUKI is about 10 miles from Piatigorsk, and resembles it in altitude and climate. It has muriated alkaline waters of great repute in Russia for chronic disorders of the digestive organs, chronic gout, glycosuria, gravel &c.

KISLOVODSK, about 14 miles to the south-east of Essentuki, is a climatic resort of medium elevation (2,700 feet), open throughout the year. The winter is very cold, but though snows and fogs occur, the number of fine sunny days is said to be great,¹ and the temperature in the sun may rise to 55° or 60° F. during the middle of the day.

ABBAS-TUMAN, with simple thermal springs (110°–120° F.), is beautifully situated amidst pine forests and rocky heights, in the Central Government of Tiflis, at an elevation of 3,505 feet above sea-level. The mountain climate of this Caucasus resort has been recommended in pulmonary tuberculosis, and the late Grand Duke George of Russia resided there. BORJOM, with its thermal alkaline springs, not far from Abbas-Tuman, has been termed the 'Russian Vichy.'

Amongst health resorts in other parts of Russia we may mention LIPETSK, picturesquely situated on the River Voronezh, in the Government of Tambof, with chalybeate springs and peat baths. CIECHOCINEK, in the north-west of Russian Poland, 2 miles from the Prussian frontier, has common salt waters, with arrangements for inhalation treatment and mud baths. BUSKO, in the south-west of Russian Poland, not far from Galicia, has sulphur waters and mud baths. SLAVUTA, in the Government of Volhynia in the south-west of Russia, is beautifully situated on the River Goryn amongst forests, and has arrangements for hydrotherapy, koumiss treatment, massage, and medical gymnastics. The resorts on the Black and Baltic Seas, noted for their salt and mud baths, have been alluded to in Chapters IV and VI respectively. At HALILA, in Finland, and various parts of European Russia, there are sanatoria for the treatment of pulmonary tuberculosis. Russia has likewise mineral springs and health resorts in Siberia and her Asiatic dominions, but we cannot enter upon them here, though they may have considerable local value.

¹ See Dr. F. G. Clenow, *loc. cit.*

CHAPTER X

THE BRITISH ISLANDS

THE characteristics of the climate of the British Islands may be explained by their latitude (between 50° and 60° north) and by their insular position, close to the continent of Europe on the south-east, and open to the Atlantic and washed by the warm Gulf Stream on the south-west and west; with this position is associated the prevalence during the greater part of the year of moist warm south-west winds laden with moisture from the ocean and warmed by the Gulf Stream. (See remarks on the origin of winds and ocean currents in Chapter I.) We will now separately consider some of the qualities of the climate.

1. Humidity, Rain, and Sunshine.—The winter fogs and the great number of rainy days in the British Islands are proverbial amongst the inhabitants of the neighbouring countries. The rainfall, though the total amount need not be greater, is more equally distributed over the different seasons than in more southern countries, and there are many more rainy days and rainy hours at English health resorts than at most health resorts on the continent of Europe. The clouds and moisture in the atmosphere diminish the amount of light and heat received from the sun, and make the climates of English health resorts relatively dull compared to those of the Swiss Alps, the Riviera, Egypt &c. On the other hand, drier regions often have the disadvantage of being more dusty than England. Naturally the western parts of the British Islands are more humid than the eastern. The mean annual rainfall of London and Dublin is between 24 and 28 inches, and that of different parts of Cornwall between 30 and 50 inches. The rainfall is greatest where the west coast is mountainous, as in parts of the west of Ireland, where the annual rainfall reaches 40 to nearly 90 inches, and as in parts of the north-west of Scotland, and the lake district of Cumberland, where the annual rainfall reaches 80 to 150 inches. The mean annual duration of bright sunshine in the British Islands varies from about 19 to 40 per cent. of the possible duration, and from about 820 to 1,800 hours.¹

¹ Average figures for fifteen years are given in *Weather Reports of the Meteorological Office, London*, vol. xii. 1897. Much importance should, of course, not be attached to little differences in the amount of sunshine. (See remarks in the section on the 'Influence of Light' in Chapter I.)

If we exclude the Channel Islands the highest figures in the tables of the Meteorological Office belong to places of the south coast of Great Britain, such as Hastings, Falmouth, Brighton, Eastbourne, and Torquay, all over 1,690 hours. Tenby, on the south of Wales, and Newquay, on the north of Cornwall, have also over 1,690 hours, and in this respect resemble localities on the south coast. Valentia, on the south-west of Ireland, has 1,487·7 hours, slightly less than Dublin. Braemar, in the Highlands of Scotland, has 1,187 hours, about the same as Edinburgh. (A later average gives Braemar 1,201·7 hours.) Fort Augustus and Fort William, in Inverness-shire, have only 822 hours (19 per cent. of the possible) and 1,098 hours (25 per cent. of the possible) respectively. (See also the general remarks in the section on the 'Influence of Light' in Chapter I.) According to the tables of the London Meteorological Office, May is the sunniest month in Great Britain (both in regard to actual number of hours and percentage of possible sunshine), that is to say, at nearly all the meteorological stations in Great Britain. Following are the months arranged according to percentage of possible sunshine at Hastings (average for years 1881-1900): May 49 per cent., July 48, August 48, June 47, September 45, April 42, March 39, October 38, February 30, November 26, December 24, January 23.

2. Equability of the Climate, Summer and Winter Temperatures, and Mean Annual Temperatures.—The humidity and prevalence of south-west winds cause the climates of the British Islands to be relatively equable. Sudden changes in the weather are common, but the extremes of heat and cold are rare. Glasgow has a difference of less than 20° F. between its mean temperatures for January and July, whilst Moscow, nearly in the same latitude, shows a difference of about 52·5° F.; and of course this difference is much greater still in parts of Siberia. The daily range of temperature in England is less than at the Swiss mountain resorts and on the Riviera, and at English health resorts there is not the same danger of chills at sunset as there is at the Riviera resorts.

The English summers are relatively cool, and the English winters relatively warm. The mean July temperature of London is 63·0° F., whilst that of Berlin, which has a somewhat more northerly latitude, is 66·7° F. In regard to the relative warmth of the English winters, Buchan¹ points out that if no more heat were received than is due to the position on the globe in respect of latitude, the mean winter temperature of London would be 17° F., but that, chiefly owing to the heat given out by the Gulf

¹ *Introductory Text-book of Meteorology*, 1871, p. 70.

Stream and carried over England by winds, the actual winter temperature of London is 21° F. higher. The winter temperature of Shetland gains still more than that of London from the warm waters of the Atlantic. Naturally the winters are warmer and the climate more equable on the south-west coasts of the British Islands than on the eastern coasts. Thus the mean January temperature is 45·4° F. for Scilly; between 43° and 44° F. for most of the coast of Cornwall and the south-western coast of Ireland; and about 37° F. for the whole of the eastern coast of Great Britain. By the side of this we may place the mean January temperatures of Paris, Berlin, and Moscow, respectively 36·3°, 32·8°, and 14° F.

For rough comparison of the temperatures of English winter resorts and of London with those of Mediterranean and other European resorts, we give on p. 236 a table of monthly means, worked out in degrees Fahrenheit from Hann (1897), de la Harpe, Glax, and other reliable sources.

The mean annual temperature of places in the British Islands likewise gains somewhat by their proximity to the Gulf Stream. Thus the mean annual temperature reaches 52° F. in the Scilly Islands (St. Mary's) and the south-west coast of Ireland; but only 49° to 50° F. in the Isle of Thanet (Ramsgate and Margate), London, and Dublin; and still less in the more inland localities. Braemar, in the Highlands of Scotland, has a mean annual temperature of only 43·2° F.

The climates of the British Islands, generally speaking, are tonic, but somewhat dull and not exhilarating, and requiring power of resistance to winds, cold damp weather, and sudden changes. It is to the winds and very frequent moderate variations of the weather that the health-giving powers of English climates may be attributed; but the patient's resisting powers must not have been too much reduced by acute illnesses, nervous exhaustion, senility &c. 'A good climate,' says Sir H. Weber,¹ 'is that in which all the organs and tissues are kept evenly at work in alternation with rest. A climate with constant moderate variations in its principal factors is the best for the maintenance of health. It calls forth the energy of the different organs and functions, their power of adaptation and resistance, and keeps them in working condition.' He adds that 'such*are the climates of England, and they belong to the most health-giving in the world. They produce the finest animals, the finest trees, and the finest men and women, and are most conducive to health and longevity.'

¹ Address before the British Balneological and Climatological Society, April 27, 1899, *Lancet*, May 20, 1899.

						Remarks
London (Brixton Meteorological Station)	44.0	39.2	38.3	40.0	42.7	From the years 1871-1895.
Ventnor (Mitchell Bruce, 1895)	47.8	42.3	41.6	41.9	43.1	From the years 1881-1890.
Hastings (Meteorological Office)	45.1	40.3	38.9	40.0	42.2	From the years 1875-1895.
Bournemouth (Mitchell Bruce, 1895)	45.2	39.7	39.6	39.7	41.7	From the years 1881-1890.
Torquay (Synnes Thompson and Lazarus-Barlow, 1895)	46.6	42.7	40.8	41.9	42.3	From the years 1880-1889.
Falmouth (Meteorological Office)	47.7	44.3	43.1	43.7	44.3	From the years 1871-1895.
Meran, } (Hann, 1897)	42.1	34.6	33.1	38.1	45.6	
Botzen, }	41.9	34.3	32.0	37.6	45.7	
Gorizia, }	45.1	38.6	37.6	39.6	45.6	
Abbazia, }	48.4	42.8	39.9	40.8	46.8	From the years 1886-1897.
Arco, } (Glax, 1900)	45.7	36.9	36.1	39.2	45.6	From the years 1885-1890.
Gardone-Riviera (Koeniger, 1901)	47.8	39.7	38.3	40.6	47.3	From the years 1885-1900.
Pallanza, }	45.3	38.8	36.5	40.1	45.3	
Cadenabbia, } (Hann, 1897)	45.5	39.6	37.6	40.6	46.0	Observations at the Villa Carlotta near Cadenabbia.
Lugano, }	42.4	36.1	34.5	39.4	45.0	From the years 1876-1887.
Locarno, } (De la Harpe, 1897)	43.0	36.9	35.1	39.9	45.3	Mean of 11 years (Mariani).
Montreux (Swiss Central Meteorological Office)	42.1	36.4	34.0	36.9	40.6	Mean of 18 years with breaks, 1864-1894.
Spezia (Olar, 1894)	52.3	46.9	45.1	48.0	51.1	
Genoa,	53.1	47.5	46.0	48.7	51.6	The temperatures for the neighbouring health resort of Nervi are doubtless somewhat higher.
San Remo,	53.2	47.8	47.1	49.5	51.4	
Nicc,	53.8	48.6	47.1	48.2	51.8	
(Hann, 1897)						
Cannes,	52.7	47.5	48.0	48.7	51.1	
Fai,	47.8	43.3	42.3	44.4	48.2	
Venice,	46.6	38.8	36.9	40.3	46.0	
Naples,	53.8	48.9	46.8	48.7	50.9	
Corfu,	59.2	53.1	50.5	51.3	54.1	
Ajaccio (Glax, 1900)	58.8	50.9	48.0	50.2	56.8	From the years 1894-1897 (Pompéani). The figures generally given for the winter months are higher.
Rome	52.6	45.6	43.5		50.7	From official figures 1876-1894.
Palermo,	59.9	54.1	51.8		55.0	
(Hann, 1897)						
Malaga,	60.6	54.7	54.9	57.0		
Funchal,	65.0	61.8	60.3	60.3	60.8	Mean of 25 years' records.
Madeira,						
Las Palmas,						
(Samier Brown, 1898)						
Grand Canary,	67.6	64.7	62.3		63.0	Mean of 5 years' records.
Orotava,						
Teneriff,	67.1	63.7	61.2	61.6	62.6	Mean of 8 years' records.
Algiers,	60.4	54.7	53.8	54.7	57.0	
(Hann, 1897)						
Cairo,	65.3	56.7		54.9		The figures given in our section on Egypt are higher than these.

We shall commence with places on the coast, and take the inland resorts afterwards.

SEASIDE RESORTS OF THE BRITISH ISLANDS

No other country has so many seaside resorts with satisfactory hygienic arrangements and accommodation. A great many of them, besides facilities for sea-bathing and boating, can boast of excellent grounds for golf, lawn tennis, and other open-air games. Some of them have establishments with sea-water swimming

baths and hydrotherapeutic appliances for cases requiring special treatment. Most of them are chiefly or only used as summer resorts, but some of them, owing to specially favourable conditions, are better or equally well known as winter resorts. Amongst the latter class are Ventnor and the Undercliff of the Isle of Wight, Bournemouth, Torquay, Falmouth, Penzance, and Hastings with St. Leonards; Rothesay, on the island of Bute, in Scotland; Glengarriff and Queenstown, in Ireland.

It is in winter that the Gulf Stream makes its modifying influence on the climate most obvious. For July the mean temperatures of places in the British Islands vary from about 55°–57° F. in the north of Scotland to about 64° F. in the south of England, the range in Ireland being from about 58°–59° F. in the north to about 62° F. in the south. Localities on the eastern coasts of the two islands have generally slightly higher mean temperatures for the summer months than localities of the same latitudes on the western coasts. For January the whole eastern coast of Great Britain has nearly the same mean temperature, viz. about 37° F., and the climate becomes gradually warmer as we proceed to the south-west. Thus the mean January temperature for Wales and the south-west promontory of England is 40° to over 43° F.; that of the south-west coast of Ireland reaching 43° F. and that of the Scilly Islands exceeding 45° F.

Speaking generally, the east and south-east coasts of Great Britain are colder and drier than its west and south-west coasts, and than the whole of the coast of Ireland, whilst the central and main portion of the south coast of England combines the relative dryness of the eastern with the relative warmth of the western coast. As we have already mentioned, it is in winter that the peculiarities in temperature caused by the Gulf Stream show themselves chiefly. Buchan has illustrated this graphically by the monthly isothermal lines, which are seen to curve along the coast-lines (sometimes parallel to them) in January, and to run nearly parallel to the lines of latitude (though having a northerly inclination from west to east) in July.

There are in the British Islands some striking instances of local modifications of climate produced by peculiar shelter from winds. The climate of the Undercliff of the Isle of Wight presents a striking contrast to that of the more exposed regions in the neighbourhood. Similarly, Penzance on the south coast of Cornwall, and St. Ives on the north coast, differ much in their climates though only separated from each other by a strip of land about eight miles across. The sheltered positions of Pwllheli in Cardigan Bay, and Grange in Morecambe Bay, give them, to some extent, 'local climates.'

The winter resorts on the coast can be used as summer resorts in cases needing a mild summer climate with great shelter from wind. The best season for the summer resorts is from the end of June to the end of September, and they are often satisfactory places until November. Many of them can be visited during winter by persons of strong constitution who require a holiday in a bracing climate, and who can stand a fair amount of wind and cold. During the spring months, when east winds are prevalent, many resorts on the west and south-west coasts have relative advantages.

SEASIDE RESORTS OF GREAT BRITAIN

We shall commence our summary of the seaside resorts of the British Islands with the coast of Kent, and proceed thence along the southern, western, northern, and eastern coasts of Great Britain, taking Irish seaside resorts afterwards. The Channel Islands have already been considered with the coast of Normandy.

Passing by SHEERNESS, on the Island of Sheppey, with its attractions to those interested in shipping, and WHITSTABLE, famous for its oyster fisheries, HERNE BAY is the seaside resort on the north coast of Kent nearest to London. It is a flat town, situated on a bay of the estuary of the Thames, directly facing north, and has a bracing climate, with little shelter from winds. We then come to the eastern extremity of Kent, still known as the 'Isle of Thanet' owing to the channel which in Roman times separated it from the rest of Kent and which was guarded on the north by the stronghold of Reculver (Regulbium) and on the south by Richborough (Rutupiæ). MARGATE (latitude 51° 23' north), on the north coast, only about 3 miles from the North Foreland, is the most bracing resort of the Isle of Thanet. As has been pointed out by Burney Yeo,¹ the north-east winds of spring reach Margate directly from the sea, whereas at many southern coast resorts they are land winds. The sandy shore affords excellent bathing, especially for children and those who prefer to bathe in shallow water. The smell around the harbour during low tide on a hot day must be admitted to be not always agreeable; Cliftonville, the 'East Hill' portion of the town, has naturally not this disadvantage, and is the most elevated and probably healthiest part of Margate. The climate of Margate has long been noted for its good effects in scrofulous and weakly children, and in convalescents and others with fair reactive powers. The 'Royal Sea-Bathing Infirmary,' founded in 1791, is probably the oldest seaside sanatorium for the poor in Europe. There are

¹ *Climate and Health Resorts*, London, 1893, p. 60.

likewise numerous convalescent homes at Margate, in connection with London and its suburbs. RAMSGATE (latitude $51^{\circ} 19'$ north), in the southern part of the Isle of Thanet, rivals Margate in popularity. On either side of the harbour rise the East Cliff and the West Cliff, and the health resort lies mostly on terraces of these cliffs, differing from Margate in having considerable shelter from north and north-east winds. The sands are excellent for bathing, but somewhat limited at rising tide. The suburb of ST. LAWRENCE, which lies mainly on elevated ground to the north-west of Ramsgate, is quieter and more bracing than the central part of the town. BROADSTAIRS, on the cliffs between Margate and Ramsgate, about $1\frac{1}{4}$ miles to the south of the North Foreland, has a full easterly exposure. It is a much quieter place than either Margate or Ramsgate, and does not so much attract the cheap excursionists from London, who often overcrowd the sands of the two latter places (especially on Sundays) during the warm weather. It has the large Yarrow Home for convalescent children of better class families of limited means. ST. PETER'S, on the plateau of Thanet, about 1 mile inland from Broadstairs, is to some extent sheltered by plantations and higher land (highest portion of Thanet only 180 feet). WESTGATE-ON-SEA and BIRCHINGTON, 2 miles and $3\frac{1}{2}$ miles to the west of Margate, are relatively quiet seaside resorts. The climate of the Isle of Thanet is influenced by its chalky soil and its exposure to winds. The vegetation is nearly everywhere scanty. According to Dr. W. Ewart,¹ the thermometric observations taken at Ramsgate and Margate agree so closely that the mean between them may be regarded as fairly correct for Thanet in general. Thus we obtain the mean temperature for the year, 49.25° F.; for July, 61.3° ; for January, 39° . Mean annual relative humidity, about 82 per cent. Mean annual rainfall (according to F. C. Bayard, 1881-1900), 23.19 inches. The flatness of the country gives Thanet a large amount of possible sunshine. The tables of the Meteorological Office (published in 1897) record 1,503 hours as the actual average amount of bright sunshine per annum at Margate (34 per cent. of the possible).

On the east coast of Kent, to the north of the South Foreland, the old-fashioned town of DEAL and the adjoining WALMER are quiet seaside resorts. In Walmer Castle the Duke of Wellington and other famous Lord Wardens of the Cinque Ports have resided.

DOVER, with its castle and chalk cliffs, forms a very striking picture to visitors from across the Channel. It faces south-east,

¹ *Climates and Baths of Great Britain*, by various authors, 1895, vol. i.

and is fairly sheltered by the chalk hills to the north. Mean temperature for July, 61.4° F.; for January, 38.8° F. **ST. MARGARET'S BAY**, about 4 miles to the north-east of Dover, faces south-east, and is distinguished (that is, the Bay proper, at the foot of the cliffs) by its shelter from every wind except the east, south-east, and south.

FOLKESTONE, about 6 miles to the south-west of Dover, is one of the most popular seaside resorts of England. The greater part of the health resort lies on the elevated ground to the west of the old town, and in front of this new portion, above the western cliffs and facing the sea, is a very airy promenade called 'The Leas.' The climate of this portion of Folkestone is bracing and naturally somewhat windy (though the range of chalk downs to the north affords some shelter), and therefore specially pleasant during hot summer weather. The climate of the houses below the cliffs and close to the sea is of course milder, owing to greater protection from cold winds. The elevated ground to the east of the old town has not become popular, but it can boast of an excellent convalescent home (St. Andrew's) for patients of the poorer classes. The beach is shingly, and the bathing rather deep for children. **SANDGATE** and **HYTHE**, about 1½ and 4½ miles to the west of Folkestone, are much quieter places and have less bracing climates than the upper portions of Folkestone. Towards the north they are sheltered by elevated ground, on part of which the large military camp of Shorncliffe is situated. **DYMCHURCH**, a village of the Romney Marsh district, about half-way between Hythe and New Romney, has capital sands for children. **LITTLESTONE-ON-SEA**, in flat country near New Romney, to the north of Dungeness, has the advantage of excellent golf-links.

HASTINGS (latitude 50° 51' north) and its more modern neighbour, **ST. LEONARDS**, which are now practically one town, lie on the Sussex coast, about half-way between the promontories of Dungeness and Beachy Head, and not far from several places of considerable historical and antiquarian interest. They face the south, and are fully exposed to the south-west wind, whilst they are sheltered from north, north-west, and partly from north-east, but not from east, winds, excepting a very limited portion of Hastings proper, including the neighbourhood of Wellington Square and the houses to the west of the Castle Hill. During late autumn and early winter months Hastings and St. Leonards are somewhat warmer than less sheltered places in the neighbourhood, such as Bexhill. On the hills behind Hastings and St. Leonards there are, however, many houses and extensive suburbs, at various elevations, which, owing to their more exposed positions, have different climates to the actual seaside quarters. Mean

temperature¹ for the year (Hastings), 49·9° F.; winter (December to February), 40·5°; spring, 46·9°; summer, 60·4°; autumn, 51·8°; January, 39·8°; July, 61·3°. Mean daily range in January, 8·4° F.; in July, 13·5° F. Mean annual relative humidity, 84 per cent. Mean annual rainfall, 29·26 inches, with 187 rainy days (most rain in the autumn months). Hours of sunshine (at St. Leonards), 1,691 in the year. There is limited accommodation for consumptive patients in the small Eversfield Hospital at the west of St. Leonards. The relative mildness of their climates has caused Hastings and St. Leonards to become best known as winter resorts, and to be somewhat neglected during summer. The winter is, however, less mild and colder than at Ventnor and the south-western winter resorts, which are preferable for weaker constitutions. During spring, especially when the east winds are keenly felt, Hastings and St. Leonards are less suitable for delicate invalids than Ventnor and the localities on the south-western coast. Hastings and St. Leonards have a good shingly beach for bathing. Their broad marine promenade, about three miles long, rivals that of Brighton. There are beautiful inland walks besides those along the coast, and many pleasant and interesting excursions can be made to localities in the neighbourhood.

BEXHILL is a modern and growing well-arranged seaside place, with golf-links and a shingly beach, 6 miles to the west of Hastings, and in a rather more exposed position. It has first-class hotels, and a fine promenade above the beach. The view across Pevensey Bay towards Beachy Head is very fine.

EASTBOURNE is a very popular summer and autumn resort, with a south-easterly aspect and a good sandy beach for bathing. It is better laid out than many other seaside resorts, and has golf-links, tennis-grounds, and attractive objects for excursions in the neighbourhood. Mean temperature for the year,² 48·6° F.; January, 37·8°; July, 60·3°. Mean annual relative humidity, 81 per cent. Annual rainfall, 26·9 inches. Amount of sunshine, 1,625 hours³ in the year. Three miles to the south-west of Eastbourne are the famous chalk cliffs of Beachy Head, which in height (515 feet) surpass those of the Stubbenkammer, near Sassnitz, on the Baltic Sea, though they are not crowned by magnificent forest like the latter. Close to Beachy Head there is

¹ The meteorological data are derived from Dr. W. Ewart's article, *loc. cit.* The tables of the Meteorological Office, however, which were published later than Dr. Ewart's article, give Hastings an average annual sunshine of 1,761 hours.

² Data from Dr. Ewart's article, *loc. cit.*

³ The tables of the Meteorological Office, however, give 1,698·3 hours (*Weather Reports*, vol. xii. 1897).

a certain amount of hotel accommodation suitable for a stay in summer when bracing air is required.

SEAFORD is a quiet place on the other side of Beachy Head, by the high ground connected with which it is to some extent sheltered from east winds. Seaford's seaside promenade extends all the way to the port of Newhaven.

BRIGHTON (latitude $50^{\circ} 50'$ north) is situated on a chalky soil within reach of the South Downs, and nearly due south of London. Its great size and easy accessibility make it a 'seaside London' during the seasons. The KEMP TOWN portion on the east cliff is more bracing than HOVE and the western parts. The 'Madeira Walks' under the east cliff are completely sheltered from the north, but are exposed to the east, and are quite different to what the word Madeira implies. During the prevalence of east winds in spring Brighton is certainly not a suitable place for invalids, but during autumn and the first part of winter up to January it offers many advantages to Londoners, and is much utilised. According to the tables of the Meteorological Office, Brighton gets 1,706.8 hours of bright sunshine in the year—that is, 466 hours more than London. Mean temperature¹ for the year, 49.4° F.; July, 60.5° ; August, 61.2° ; December, 40° ; January, 39.3° . Mean annual relative humidity, 78 per cent. Mean annual rainfall, 30.43 inches. Mean temperature of the sea in July, about 62° F. Some portions of Brighton stretch a considerable distance inland. There is likewise hotel accommodation at HASSOCKS, $7\frac{1}{2}$ miles inland, suitable for those who wish to be within easy reach of Brighton and yet feel better when they reside away from the actual coast. On the South Downs, near Brighton, there are bracing sites of considerable elevation (as the neighbourhood of the Devil's Dyke, 5 miles distant, and about 1,000 feet above sea-level), which might be utilised in certain cases where suitable accommodation is to be provided.

WORTHING lies on low ground about 10 miles to the west of Brighton, and is under similar conditions in regard to winds, excepting that the sheltering downs on the north are further removed. It is a much quieter place, and the climate is somewhat less bracing, but the temperature figures of the two places are not very different. The mean monthly temperatures, according to the figures given by F. C. Bayard for the years 1881–1900, are all slightly lower at Worthing than at Brighton.

LITTLEHAMPTON is a quiet little place on the flat ground below Arundel Castle and boasting excellent sands for children. BOGNOR (Sussex) and HAYLING ISLAND (Hampshire) have likewise capital

¹ Data from Dr. Ewart's article, *loc. cit.* The mean temperatures given by F. C. Bayard for 1881–1900 are all somewhat higher.

sands for children. Hayling Island is a flat country, very little above sea-level, but with pleasant lanes and plenty of foliage. It has a sea-frontage of over four miles, with firm sands, facing south, and commanding a view of part of the Isle of Wight and the ships at Spithead. **SOUTHSEA** is practically a suburb of Portsmouth. Both Southsea and Littlehampton have a strip of common ground separating the houses from the sandy shore, resembling in this respect some of the Baltic resorts. **SOUTHAMPTON** is not actually on the sea. Close to it is the great military hospital of Netley, which is under marine influence. Pleasant excursions to localities in the New Forest (see further on, under Inland Resorts of Great Britain) can be made from Southampton.

The **Isle of Wight** (latitude $50^{\circ} 35'$ to $50^{\circ} 45'$ north), 3 to 6 miles from the coast of Hampshire, owing to its hills (up to 830 feet) and cliffs and the local shelter they afford, has several different 'local climates.' **COWES** and **RYDE**, on the northern coast, are summer pleasure resorts, yachting stations, and good places for excursions on the sea. Close to East Cowes is 'Osborne House,' formerly a residence of Queen Victoria, and now a convalescent home for officers in the army and navy. **SEA VIEW**, in the district of **ST. HELENS**, about 3 miles east of Ryde, is a small quiet summer and autumn resort with good bathing. **SANDOWN**, on Sandown Bay, facing south-east, is a bracing breezy resort, without much shelter from winds. The remains of a Roman villa show that this neighbourhood was appreciated in early times. **SHANKLIN**, in Sandown Bay, about 3 miles to the south-west of Sandown, has, in common with many other health resorts, somewhat different climates in its different portions, owing to the slope of the land towards the shore. It has a chalybeate water poor in carbonic acid gas, and a modern thermal establishment for various kinds of baths &c. Shanklin Chine, a beautiful rocky wooded glen, is one of the great attractions of this health resort to ordinary visitors.

THE UNDERCLIFF OF THE ISLE OF WIGHT WITH VENTNOR AND BONCHURCH.—The Undercliff is a narrow strip of coast land between the sea and the high cliffs which form the precipitous face of the downs in the south-eastern part of the island. It consists of irregular terraces of chalk and sandstone, formed as the result of landslips from the cliffs, and rising* to a height of 100 or 150 feet above sea-level. It extends for about 6 miles from Luccombe Bay, on the east, to Blackgang Chine on the west, and its aspect is mostly due south, the eastern extremity, however, facing south-east, and the western extremity south-west. The downs to the north of the Undercliff reach 400 to 800 feet above sea-level. The position is sheltered from the north, north-

east, north-west, west, and partly from the south-west and east, though it must not be supposed that winds from these directions are not felt. Ventnor is exposed to the south and south-east winds. The houses of Ventnor cannot all have quite the same climate, for they are situated at various elevations from that of the beach to that of portions of the cliff nearly 500 feet above sea-level. Bonchurch, which is practically the eastern suburb of Ventnor, is somewhat better protected from the east. The soil absorbs water and leaves the surface dry, and in dry weather the roads may be disagreeably dusty. The warmth of the sun is increased by reflection from the cliffs and sea, and the winter climate may be described as mild and equable, yet fairly dry and not 'relaxing.' The remarkable local climate of the Undercliff was thoroughly recognised by Sir James Clark, and the results obtained by the Royal National Hospital for Consumption at Ventnor (situated somewhat to the west of the town of Ventnor), founded in 1869 by Dr. A. Hill Hassall, have served to maintain the good reputation of this small district. Of British winter resorts it is one of the best for a variety of cases. We must, however, refer to Part III for the indications for mild seaside winter climates in pulmonary and other cases. The following meteorological data are derived from Dr. Mitchell Bruce's article on Hampshire in the 'Climates and Baths of Great Britain.'¹

The mean monthly temperatures, beginning with January, are: 41·6° F., 41·9°, 43·1°, 47·3°, 53·3°, 58·3°, 61·2°, 61·8°, 59·1°, 52·1°, 47·8°, 42·3°. Mean annual temperature, 50·8° F. Mean daily range for the year, 10·6° F. Mean annual relative humidity (for 9 A.M.), 81 per cent. Mean annual rainfall, 28·13 inches, with 164 rainy days fairly distributed between the different seasons. The annual sunshine amounted to 1,638 hours at St. Lawrence, that is, near the Ventnor Hospital for Consumption.

At the western end of the Isle of Wight, FRESHWATER GATE, in Freshwater Bay, ALUM BAY, and TOTLAND BAY are quiet seaside summer resorts not far from the inland railway station of Freshwater; they are fully exposed to Atlantic breezes. YARMOUTH, a picturesque little town on the coast, 2½ miles to the north of Freshwater, and NEWPORT, near Carisbrooke Castle, 9½ miles inland to the east of Yarmouth, hardly rank as health resorts.

BOURNEMOUTH, in the south-west of **Hampshire**, close to Dorsetshire and Poole Harbour, has a dry sandy soil, and is tolerably sheltered by low hills and pine plantations from north

¹ London, 1895, vol. i. F. C. Bayard (for years 1881-1900) gives the mean January temperature 41·3° F., but all the other mean monthly temperatures slightly higher than those given by Mitchell Bruce, the mean annual temperature being 51·2° F.

and north-east winds, but to a very limited extent from east winds. The houses and hotels of the health resort proper are mostly on the east and west cliffs (fairly high, of sandstone), and between these two quarters are the sheltered public gardens of the valley of the Bourne. There are excellent promenades above the cliffs, along the sea-front, which faces south. Bournemouth is perhaps slightly less sheltered from cold winds than Ventnor or Torquay, but its climate is more tonic, and it has the advantage of pine plantations and a sandy soil, in both of which it has been compared to Arcachon, in France. Bournemouth, however, including its suburbs, now forms a great town, and much of the pinewood has been cut down to give space for building purposes. Bournemouth and Ventnor are probably the two most esteemed winter climatic resorts in England for cases of chronic pulmonary tuberculosis, and various private sanatoria for consumptives have been established in Bournemouth and its neighbourhood. The mean monthly temperatures,¹ commencing with January, are: 39·6° F., 39·7°, 41·7°, 46·2°, 53·3°, 59·4°, 62·6°, 61·7°, 57·7°, 49·8°, 45·2°, 39·7°. Mean annual temperature, 49·7° F. Mean annual relative humidity, 77·7 per cent. Mean annual rainfall, 27·26 inches, fairly equally distributed over 158 rainy days. Average annual amount of sunshine (taken at Southbourne), about 1,550 hours.

BOSCOMBE, to the east, and BRANKSOME, to the west, with its beautiful Park and 'Chine,' are suburbs of Bournemouth. SOUTHBOURNE-ON-SEA, practically also a suburb, is situated on a plateau above a sandy cliff (100 feet), near Christchurch (celebrated for its ancient Priory Church), and about 3½ miles to the east of Bournemouth; it has a less sheltered and more bracing climate. PARKSTONE, a village in Dorsetshire, on Poole Harbour, 3 miles to the west of Bournemouth and close to Poole, is said to have a specially mild winter climate. About 2 miles from Parkstone station, at a site about 200 feet above the sea, amidst pinewoods and heather lands, is the 'Alderney Manor' private sanatorium for pulmonary diseases. SWANAGE, in a little bay on the eastern side of the 'Isle of Purbeck' peninsula, is a quiet summer resort for sea-bathing.

WEYMOUTH, or rather MELCOMBE REGIS, a suburb of Weymouth, is situated nearly due south of Dorchester, on a bay exposed to the east. It is a resort for summer and autumn, and has an excellent sandy beach for bathing. The mean monthly temperatures for May to October are: 52·6° F., 58·4°, 61·3°, 61·6°,

¹ Taken for the Council of the Borough of Bournemouth. See Mitchell Bruce, *loc. cit.*

58.5°, 51.8° respectively, and the mean annual rainfall is 27 inches (means for period 1881–1900 as given by F. C. Bayard).

LYME REGIS, on the Dorsetshire coast between Weymouth and Sidmouth, is sheltered from the north and has good sands for bathing. CHARMOUTH is a smaller place $1\frac{1}{2}$ miles to the east.

SEATON and BEER (Devonshire), situated close together, about half-way between Lyme Regis and Sidmouth, may be used as quiet summer resorts.

SIDMOUTH, in the south-east of **Devonshire**, sheltered from the north and east by a semicircle of hills, has a mild climate and a reputation for an unusual amount of winter sunshine. Its small sea-front, confined by red sandstone cliffs on either side and rich green background, forms a very striking picture. In its shelter from winds, its luxuriant foliage, and its excellent hotel accommodation, it rivals Torquay. It possesses a good thermal establishment for baths and douches of various kinds. The mean monthly temperatures (1881–1900, given by F. C. Bayard) are the following, beginning with January: 40.6° F., 41.3°, 42.5°, 46.9°, 51.8°, 57.5°, 60.2°, 60.1°, 57.2°, 50.6°, 46.6°, 42.5°; mean annual temperature, 49.8°; mean annual relative humidity at 9 A.M., 83 per cent.; mean annual rainfall, 31.58 inches; number of rainy days in the year, 198.

TORQUAY (latitude 50° 32' north), situated on Tor Bay, faces partly south and partly south-west, and is sheltered by encircling hills from the north, north-west, and to some extent from the north-east. The villas and hotels of the health resort are built amidst rich and in some parts almost subtropical vegetation along the shore and in terraces on the sides of the hills. There are good opportunities for walking exercise both on level and sloping ground. Torquay is one of the best known and most attractive British winter resorts, and in regard to its climate may be compared to Queenstown, in Ireland. The mean temperatures¹ for the various months are the following, beginning with January: 40.8° F., 41.9°, 42.3°, 45.7°, 51.3°, 56.5°, 59.5°, 59.9°, 56.4°, 49.8°, 46.6°, 42.7°. Mean annual temperature, 49.4° F. Mean daily range, 11.8° F. Annual amount of bright sunshine, 1,698 hours. Mean annual relative humidity, 82.3 per cent. Mean annual rainfall, about 35 inches, distributed over 187 days. Torquay is too hot for some persons in summer, though its 'hot-house' climate is, of course, even then tempered by sea-breezes.

BABBACOMBE, in Babbacombe Bay, and PAIGNTON, a large growing resort, in the centre of Tor Bay, are both close to Torquay,

¹ See the article on Devonshire by Dr. Symes Thompson and Dr. Lazarus-Barlow in the *Climates and Baths of Great Britain*, 1895. Portions of the south coast (Sidmouth and part of Torquay) constitute a kind of 'Devonshire Riviera.'

but face east and are less sedative. DARTMOUTH, at the broad mouth of the Dart, likewise faces east.

The other resorts on the south coast of Devonshire, BUDLEIGH SALTERTON, EXMOUTH, DAWLISH, TEIGNMOUTH, and SALCOMBE, have a fair amount of shelter and tolerably warm equable winters, but their sheltered grounds for exercise are rather limited. These localities are much visited during summer; the facilities for sea-bathing are less at Salcombe than at the other places. Two miles from Teignmouth, to the north of the Teign estuary and at the south-western foot of the Haldon (800 feet), is BISHOPS-TEIGNTON, with a pleasantly situated 'hydropathic,' 200 feet above sea-level.

In **Cornwall** the first place to be mentioned is FOWEY, a small sea-port, at the mouth of the River Fowey, about half-way between Plymouth and Falmouth. It possesses satisfactory hotel accommodation, and has been compared to Dartmouth, only that it is much smaller.

FALMOUTH, in Cornwall (latitude $50^{\circ} 8'$ north), has a beautiful and sheltered position on the western side of Falmouth Harbour, and has been highly praised as an equable winter resort for patients who wish to remain in England, though they suffer from bronchitis and other troubles in colder and more inclement parts of the island. Of course it is the newer portion of Falmouth, not the cramped old town, which is the health resort. The small village of FLUSHING, on the opposite side of the harbour, has a westerly aspect and is still better sheltered; east winds are hardly ever felt there. The mean monthly temperatures of Falmouth¹ are the following, beginning with January: 42.7° F., 43.0° , 43.1° , 46.2° , 51.7° , 57.2° , 59.9° , 59.5° , 56.3° , 50.3° , 47.8° , 44.2° . Mean annual temperature, 50.1° F. Mean daily range, 8.5° F. Mean annual relative humidity, 82 per cent. Mean annual rainfall, 44 inches in 212 days. The tables of the Meteorological Office (which were published in 1897) give Falmouth an average of 1,734.4 hours of bright sunshine in the year.

Between Lizard Point and Land's-End we come to PENZANCE (latitude $50^{\circ} 8'$ north) in Mounts Bay, the most westerly seaside resort in England. It is built on the western side of the bay, facing south-east, and sheltered by elevated ground behind it. It has slightly higher mean annual and mean winter temperatures, and a slightly lower daily range than Falmouth. MARAZION, opposite St. Michael's Mount, 3 miles to the east of Penzance,

¹ See Dr. W. H. Dickinson's article on 'Cornwall' in the *Climates and Baths of Great Britain*, vol. i. 1895. The mean monthly temperatures given by F. C. Bayard (for the years 1881-1900) are all somewhat higher than the figures given by Dickinson, the mean annual temperature being 51.1° , exactly one degree higher. Some of the south coast can perhaps be termed a 'Cornish Riviera.'

faces south, but has a very similar climate. The mean monthly temperatures¹ for Penzance are the following, beginning with January: 42·4° F., 43·4°, 43·9°, 47·1°, 52·6°, 57·7°, 60·9°, 61·3°, 57·3°, 51·3°, 47·7°, 44·2°. Mean annual temperature, 50·7° F. Mean daily range, 7·8° F. Mean annual rainfall, 42·59 inches. If we compare Falmouth and Penzance with Torquay, we find that the first two are somewhat warmer, but rather less sheltered than the last.

The SCILLY ISLANDS (latitude 49° 40' north) are a group of small islands to the south-west of Land's-End, 40 miles from Penzance, from which they can be reached in about 4 hours. Situated right in the Gulf Stream, it is natural that they are still warmer than Penzance. Tropical plants flourish in the gardens of TRESKO. In ST. MARY'S² the mean monthly temperatures are the following, beginning with January: 45·4° F., 45·2°, 45·3°, 47·5°, 51·9°, 56·6°, 70·2°, 60·5°, 58·1°, 52·4°, 50·1°, 46·8°. Mean annual temperature, 52·4° F. Mean daily range, 7·1° F. Mean annual relative humidity, 85 per cent. Mean annual rainfall, about 32 inches, spread over 212 days. There are no elevations to speak of in the islands, so that very few parts are much sheltered from winds.

The **north coast of Cornwall and Devonshire** has several summer resorts, some of which, such as St. Ives, in Cornwall, and Ilfracombe, in Devonshire, though more exposed to winds than Torquay, Falmouth, and Penzance, might be used for winter residence in certain cases. ST. IVES, on the western side of St. Ives Bay, chiefly facing the east and fairly sheltered from the west, has a more bracing climate than Penzance, from which it is separated by a strip of land only about eight miles across. The cramped old fishing town itself is hardly a health resort, but the Tregenna Castle Hotel, an old manor house in grounds of its own, a short distance from the town, has suitable accommodation. NEWQUAY (to be distinguished from New Quay in Cardiganshire) is doubtless the most popular summer and autumn resort on the north coast of Cornwall, and has good firm sands for bathing. There is a certain amount of shelter from the east. It gets 1,691 hours of bright sunshine in the year according to the tables of the Meteorological Office. About 2 miles to the north-east of Newquay, situated just above the sandy TREGURRIAN or WATERGATE BEACH, is the new Watergate Bay Hotel, with fair shelter from the east. PADSTOW can hardly at present be classed as a health resort. It is situated on the estuary of the Camel, and not on the open sea. TINTAGEL is a moderately bracing summer and autumn resort, with good hotel accommodation. Some of the

¹ See Dr. Dickinson's article, *loc. cit.*

² *Ibid.*

houses in the neighbourhood have an elevation of 200–300 feet or more above sea-level. On a promontory here are situated the ruins of the castle celebrated in the tales of King Arthur and the Round Table. BOSCASTLE, a few miles further east, likewise has hotel accommodation. Tintagel and Newquay have probably the most attractive coast scenery on the north of Cornwall. BUDE faces west, and is fairly sheltered by high ground towards the east. There is no lack of golf courses in Cornwall.

On the north coast of Devon we have Ilfracombe, Lynmouth, and Lynton, with several minor seaside resorts. CLOVELLY is a most picturesque village on the south side of Barnstaple (or Bideford) Bay. WESTWARD HO, in the same bay, 12 miles further east, has not the romantic situation of Clovelly, but is a quiet modern little place, with good firm sands and excellent golf-links. WOOLACOMBE, in the centre of Morte Bay, faces west and is sheltered by high ground on the east. It has extensive sands and good golf-links, and is a spring, summer, and autumn resort, with modern hotel accommodation. MORTHOE, further north, close to Morte Point, has a more exposed position than Woolacombe. ILFRACOMBE is the chief health resort of North Devonshire. There is a good deal of shelter from the heights surrounding the harbour, but easterly and westerly winds are often much felt. The mean monthly temperatures at Ilfracombe (1881–1900, given by F. C. Bayard) are as follows, beginning with January: 43·1° F., 43·1°, 44·2°, 48·2°, 52·8°, 58·5°, 60·8°, 61·4°, 58·8°, 52·7°, 48·9°, 44·9°. Mean annual temperature, 51·5°. Mean annual rainfall, 38·35 inches. LEE-ON-SEA is a small summer resort about $2\frac{1}{2}$ miles to the east of Ilfracombe. LYNMOUTH lies to the north of Exmoor, on low ground between high hills at the mouth of the Lynn, and LYNTON is situated on the steep slopes to the west of the stream, 400–500 feet above the sea. Both places are very picturesque and offer satisfactory accommodation. They are connected by a funicular railway.

MINEHEAD, WESTON-SUPER-MARE, and CLEVEDON are summer resorts on the **Bristol Channel**, in Somersetshire, much frequented by inhabitants of the West of England. The large expanse of muddy sand at low tide may help in the generation of ozone, but is generally regarded as a drawback from the artistic, if not from the sanitary, point of view. There is of course no bathing at low tide. The neighbourhood of these places allows of pleasant walks and interesting excursions. About 6 miles to the west of Minehead is PORLOCK, in a very picturesque neighbourhood, and close by, about 1 mile inland, is the pretty village of Bossington. Weston has a mean temperature for July, 61° F.; for January, 40·5°; for the year, 49·9°. Its mean

annual rainfall is about 29 inches. It is protected from north winds by the well-wooded Worlebury Hill (about 300 feet), on which some of the pleasantest walks in the neighbourhood may be taken. The most sheltered houses are of course those built on the side, or close to the foot, of the hill. Most of the town is on flat ground, very little above sea-level. Clevedon is a more picturesque place, and on the whole quieter, being less thronged by 'one-day excursionists' from Bristol &c. It is situated on somewhat hilly ground, and has a rocky irregular sea-front; the beach is of muddy sand and stones, inferior to the sands of Weston for bathing. Part of the town is sheltered on the north by the Dial Hill (about 300 feet) and the adjoining high ground. PORTISHEAD, on the Severn Estuary, to the north-east of Clevedon, can claim pleasant hilly country for walking. It now has good hotel accommodation, and is only $11\frac{1}{2}$ miles by railway from Bristol.

In Glamorganshire, on the northern side of the Bristol Channel, PENARTH and THE MUMBLES may be regarded as sea-bathing suburbs of the important towns of Cardiff and Swansea respectively. The summer resort of The Mumbles is an enlargement of the little fishing village of Oystermouth and is built on the western horn of Swansea Bay, of which it commands a beautiful view. It is sufficiently removed from the foundries of Swansea, is sheltered by elevated ground from the violent south-west winds, and has the mild climate of the district. It is a centre for excursions to many picturesque spots in the Gower Peninsula, of which it forms the eastern extremity. The mean annual rainfall is about 41 inches.

TENBY, one of the oldest and most important and most beautiful seaside resorts of **Wales**, is picturesquely situated on a rocky promontory rising about 100 feet above sea-level on the western side of Carmarthen Bay. It has a fairly mild climate, and is to some extent used for winter residence, as well as during the summer season. Its annual amount of bright sunshine averages 1,694 hours. The mean annual rainfall is about 45 inches. The sandy shores to the north and to the south are both used for bathing.

ABERYSTWITH, on Cardigan Bay, faces west and has an equable mild climate. It possesses a broad marine promenade and a good beach for bathing. Amongst neighbouring resorts in Cardigan Bay are ABERAYRON and NEW QUAY to the south, and ABERDOVEY and TOWYN to the north.

BARMOUTH, further north on Cardigan Bay, is built at the south-western foot of high rocky and grassy slopes in the angle between the picturesque estuary of the Mawddach on the south

and the sea on the west. It has a dry sandy soil, and extensive muddy sands at low tide. The inland country near Barmouth, including Dolgelly and the heights of Cader Idris, is most picturesque. Harlech Castle is about 10 miles north. Barmouth is sheltered from the north and east, and can be used as a winter resort by those able to bear a certain amount of cold wind.

CRICCIETH is a small summer resort on the northern shore of Cardigan Bay, to the south of the Snowdon district. PWLLHILI, a little further west, has a sheltered position owing to the neighbouring mountains, and is more suited for winter residence. The new west-end portion of Pwllheli has a fine beach, which the old town lacks.

BEAUMARIS, on the Menai Straits, the chief town of the Isle of Anglesey, has a position open to the east, and is a moderately bracing summer resort. Like the towns of Bangor and Carnarvon (not strictly speaking health resorts) on the opposite side of the Menai Straits, it also serves as a centre for summer excursions. HOLYHEAD, where the mail steamers start for Dublin, has a July and August temperature of about 59·4° F., and a range of less than 18° F. between its mean monthly temperatures.

LLANDUDNO, the well-known resort on the north coast of Wales, is situated at the south-eastern foot of the high rocky mass (up to 680 feet) constituting Great Orme's Head, in the flat valley connecting Orme's (Llandudno) Bay with Conway Bay. Orme's Bay is its chief sea-front, but a few houses face Conway Bay. It is a spring, summer, and autumn resort, with an equable climate, and might occasionally be recommended as a winter resort for persons from the West of England who can bear a good deal of wind. The portion closest to Great Orme's Head is well sheltered from the strong west winds. Mean temperature for the year, 49·7° F.; for July, 60·1°; for January, 40·9°. Mean annual rainfall, 31·14 inches. Average annual bright sunshine, about 1,350 hours. There is likewise accommodation close by at CONWAY, famous for its magnificent castle, at the opening of the beautiful Vale of Conway, in which lie Trefriw, Llanrwst, and Bettws-y-Coed. Conway itself cannot be called a health resort, but high up in the hills about a mile inland is the pleasantly situated OAKWOOD PARK HOTEL. About 4½ miles west of Conway is the seaside resort of PENMAENMAWR, situated in a semicircle of hills facing north-west. In the pleasant wooded country between Conway and Penmaenmawr is PENDYFFRYN HALL (NORDRACH IN WALES), a private sanatorium for tuberculosis. A few miles to the east of Conway, on the eastern side of the peninsula on which Llandudno is situated, is COLWYN BAY, a growing rival of Llandudno, with good sea-bathing and beautiful inland walks. It is to some

extent visited in the colder months as well as in the regular season. Further east is RHYL, on flat ground, with good sands for bathing, frequented as a summer resort by the inhabitants of Liverpool, Chester, &c. It has a good modern hospital, where patients of the poorer classes, notably scrofulous children and convalescents, can get the benefit of seaside treatment. PENSARN and PRESTATYN, respectively to the east and west of Rhyl, though at present not very attractive places, are both visited as summer resorts.

HOYLAKE and NEW BRIGHTON (Cheshire, '**Wirral Peninsula**') are situated respectively at the western and the eastern corners of the low-lying strip of coastland between the estuaries of the Dee and the Mersey. They can be quickly reached by railway from Liverpool. Hoylake and its neighbour, WEST KIRBY, are mainly residential places, but New Brighton is a favourite resort of excursionists. Much muddy sand is exposed at low tide. The Hoylake golf-links are good. SOUTHPORT, on the **Fylde coast** of Lancashire, 18 miles north of Liverpool, and BLACKPOOL, further north, beyond the estuary of the Ribble, are valuable resorts for the inhabitants of Liverpool, Manchester, and the commercial industrial towns of this part of England. Southport has an open position on flat ground, facing north-west, and is an important residential town as well as a summer and autumn health resort. Part of the extensive sandy area in front of the esplanade has been converted into 'marine lakes' and is used for boating. Blackpool (mean July temperature, 59.3° F.; mean annual rainfall, 33.88 inches, for years 1881-1900) has a similar open position, but it faces west and there are no 'marine lakes,' as there are at Southport, separating the front of the town from the sea. Owing partly to its 'Eiffel tower,' variety entertainments, arrangements for dancing &c. it is more thronged by 'trippers' than Southport is. A drawback of Blackpool, as of Southport, is that there are practically no short inland excursions to be made. Blackpool is separated by a stretch of sand-dunes from the residential seaside resorts of ST. ANNE'S-ON-THE-SEA and LYTHAM on the south. On a headland a little to the north of Blackpool is FLEETWOOD, whence steamers run to Ireland &c.¹

GRANGE-OVER-SANDS has a beautiful and sheltered position on the northern shore of **Morecambe Bay**, to the south of the mountainous Lake District, and in some cases can be used as a winter resort for this part of England. Grange may perhaps be said to bear a similar relation to the English Lake District as

¹ In regard to the climatology of these resorts on the 'Fylde' coast, that is, the projecting coast of Lancashire, between the estuaries of the Lune and the Ribble, see a short article by F. J. S. Heaney in the *Journal of Balneology and Climatology*, London, January 1906, p. 29.

Glengarriff in Ireland bears to the Killarney Lake District, and it may be termed a 'Lancashire Riviera' as Glengarriff is an 'Irish Riviera.' MORECAMBE, further south, near Lancaster, is much frequented by excursionists. At both Grange and Morecambe a vast expanse of sand is exposed during low tide. On a hill (200 feet) near Kendal, about a mile inland from Morecambe Bay, is the small Westmorland Sanatorium for the consumptive poor of this county. Further north, ST. BEES and SILLOTH may be mentioned as quiet seaside resorts on the coast of Cumberland, the former near the rocky promontory of St. Bees Head, the latter on the Solway Firth.

The **Isle of Man**, situated in the midst of the Irish Sea (between latitudes 54° and $54\frac{1}{2}^{\circ}$ north), is much frequented in summer rather as a holiday than a health resort. It has quite an 'insular' climate with cool summers and comparatively warm winters. DOUGLAS, built around an open bay of the eastern coast, is the largest town, and that most frequented by visitors, who include great numbers of holiday makers from the commercial centres of the West of England. RAMSEY, on the north-east, PEEL, on the west, and PORT ERIN (on a little bay facing west), on the south-west of the island, are the other Manx resorts to be mentioned. Mean temperature (Douglas) for July, 57.5° F.; for January, 40.2° F. Mean annual rainfall, $41\frac{1}{4}$ inches. Average annual sunshine, 1,592 hours.

On the **west coast of Scotland** there are several summer resorts (mostly with beautiful scenery) on the Firth of Clyde, including ARDROSSAN, MILLPORT (Great Cumbrae Island), LARGS, WEMYSS BAY, HELENSBURGH, and DUNOON. INELLAN, KIRN and HUNTER'S QUAY are neighbours of Dunoon, but smaller and quieter. Dunoon itself, like Rothesay, is often excessively crowded by one-day summer excursionists. At Wemyss Bay and near Helensburgh (SHANDON on the Gareloch) there are well-known 'hydropathics.' On the hills to the south of the mouth of the Clyde at the BRIDGE-OF-WEIR railway station is the RANFURLY HOTEL, in an open situation. Not far distant is the sanatorium for poor consumptives instituted by Mr. William Quarrier, of Glasgow. The ISLE OF ARRAN, in the Firth of Clyde, which is used as a summer holiday resort by the Scotch, has fine mountain, woodland, and marine scenery, good walks, and sea-bathing. ROTHESAY (latitude $55^{\circ} 50'$ north), in the island of Bute, is a favourite summer resort of this region, often crowded owing to the facility for one-day excursions. It has a moist equable climate, with a mean temperature for the three summer months of about 58.1° F.; and for the three winter months of 39.3° F.; annual rainfall, about 40 inches. As a winter resort its cloudiness and absence of sunshine are disadvantages, and it is too

moist for most invalids, excepting some of those with chronic bronchitis. OBAN, further north, in Argyllshire, is a rainy place and perhaps best known as a starting-point for tours in the Western Highlands. Mean temperature for January, 39·8° F.; for July and August, 57·3°; for the year, 48·2°. Mean daily range, 10·3° F. Mean annual rainfall, 52 inches. Owing to the free drainage and dry sandy subsoil the mean annual relative humidity is apparently only 74·8 per cent.¹ Oban lies on a small bay sheltered by the surrounding heights from cold winds.

On the **east of Scotland**, which is drier and more bracing, the best known seaside resorts are probably Nairn, Portobello, and North Berwick. Before, however, proceeding with the eastern seaside places of Great Britain, we may repeat that the mean January temperature is, as Buchan has shown, about the same (that is, about 37° F.) along the whole extent of the eastern coast, whereas the July temperature means increase gradually from north to south (from about 56° to 62° F.). The Government meteorological records of NAIRN for 25 years quite accord with this. Mean temperature for January, 37·1° F.; for July, 57·5°; for the year, 46·2°; for the three summer months, about 55·4°. Nairn is situated on the southern shore of the Moray Firth, and at the northern edge of a level sandy plain, with the mountainous country of the Highlands to the windward; this position, as Cruickshank² points out, accounts for the relatively small rainfall, which is only 24·53 inches (about the same as that of London) on the average for the year. The subsoil is porous and dries rapidly after rain. It is a capital place for golf. Further north than Nairn is DORNOCH, the county town of Sutherland, facing east, with good sea-bathing and golf-links. Further along the coast to the east of Nairn, MACDUFF, close to Banff, may be mentioned. Considerably further south, in latitude 57° 8' north, between the mouths of the Dee and the Don, is the city of ABERDEEN, which has good sands for sea-bathing to the north of its seaport, though they are at some distance from the dwellings. On the 'DEESIDE,' 5 miles from Aberdeen, is a large 'hydropathic.' About 30 miles along the coast to the north of Aberdeen is CRUDEN BAY, with bracing air, modern hotel accommodation, and golf-links. STONEHAVEN, the county town of Kincardine, 16 miles south of Aberdeen, is sometimes used as a summer resort for its bracing air and sea-bathing. BROUGHTY FERRY, at the mouth of the Firth of Tay, is practically a seaside suburb of Dundee, just as PORTOBELLO, on the Firth of Forth, is of Edinburgh; both places are naturally

¹ See Dr. E. Baily's *Oban: a Health and Holiday Resort*.

² See Dr. Brodie Cruickshank's 'Notes on Nairn,' *Journal of Balneology and Climatology*, 1899, vol. iii.

often crowded with excursionists. The old university town of ST. ANDREWS, on the coast of Fifeshire, has a bracing climate for strong constitutions, and is a great golfing centre. ELIE (with EARLSFERRY), further south, on the opposite side of Fife Ness, has good golfing, and there are also other seaside places on the coast of Fifeshire, such as CRAIL, near Fife Ness, and LARGO, in Largo Bay, which are bracing summer resorts for sea-bathing and golfing. On the southern shore of the entrance to the Firth of Forth, opposite to Elie, is the bracing and popular seaside summer resort of NORTH BERWICK, much frequented by visitors from Edinburgh, from which it is 22 miles distant. Its shore, partly sandy, partly rocky, is fully exposed to the north-east. Behind the town there is some rising ground, and a steep hill, called 'the Law,' one of the isolated hills of this region, like the Castle Hill and Arthur's Seat at Edinburgh. North Berwick is a good place for golf. Still nearer to England is DUNBAR, with its historical associations, bracing climate, and good golf-links.

Remaining on the eastern coast, we will now proceed with the seaside resorts of England down to the estuary of the Thames. TYNEMOUTH, in Northumberland, on the mouth of the Tyne, is a popular summer resort of the inhabitants of Newcastle-upon-Tyne, whence it is only 20 minutes distant by railway. ROKER-ON-SEA is the sea-bathing suburb of Sunderland (Durham).

In **Yorkshire** there are Redcar, Saltburn, Whitby, Scarborough, Filey, and Bridlington. REDCAR (of which COATHAM forms the western portion) is a popular resort with simple inexpensive accommodation. It has no cliffs, but a good sandy beach, such as children delight in, which extends all the way to Saltburn, $5\frac{1}{2}$ miles to the south-east. SALTBURN-BY-THE-SEA is a relatively quiet summer resort, built above a cliff of moderate height facing north. Like Redcar, it has excellent sands, and it also possesses a sea-water swimming bath, and arrangements for strong brine baths, for which a brine is used obtained from the brine wells of Middlesborough, containing 25 per cent. common salt. WHITBY is a favourite and bracing summer resort, rather quieter than Scarborough. The coast at Whitby faces almost due north. The old town lies cramped in a narrow valley on both banks of the mouth of the Esk and on the steep slopes of the cliffs on either side. Above, on the West Cliff, is the modern summer resort, and the East Cliff, on the other side of the town, is crowned by the quaint old parish church and the famous ruins of St. Hilda's Abbey. A favourite excursion from Whitby is to ROBIN HOOD'S BAY, a picturesque but cramped little village, about 7 miles to the south-east; a shorter excursion is to

SANDSEND, another pretty village, with accommodation for visitors, 3 miles along the coast to the north-west. SCARBOROUGH (latitude $54^{\circ} 17'$ north), the most important seaside resort of the north of England, has a splendid and picturesque position at various elevations above sea-level. The shore at Scarborough is divided by a rugged promontory into a North Bay and a South Bay, the latter of which is the more beautiful and attractive of the two. The promontory crowned by the castle ruins (290 feet) helps to shelter the South Bay portion of the health resort from the north-east. The South Cliff, on the southern part of the South Bay, is the most fashionable quarter, and is separated from the old town by a deep chasm ('Ramsdale Valley') spanned by two fine bridges. Though the Spa Promenade and Spa Gardens are imposing features of this health resort, the mildly aperient mineral waters of the 'Spa' are of secondary importance for most cases compared to the bracing and relatively dry seaside air. Scarborough, like Lowestoft and some other summer resorts of the east coast, may under certain circumstances be visited by patients of vigorous constitutions during the colder months, even during winter. Mean temperature (according to F. C. Bayard, 1881-1900) for January, 38.1° F.; for July, 59.1° ; for the year, 47.7° . Mean annual rainfall, 27 inches. FILEY, in Filey Bay, 8 miles from Scarborough, likewise mostly on elevated ground, is a much quieter place than its neighbours on either side. Three miles further south is BRIDLINGTON QUAY, a bracing and popular summer resort, rather overrun by 'cheap excursion' visitors. It is sheltered on the north by Flamborough Head, a bold promontory (with perpendicular cliffs, 450 feet high) which separates Bridlington Bay from Filey Bay. Between Bridlington and the mouth of the Humber are the two small Yorkshire seaside resorts of HORNSEA and WITHERNSEA.

SKEGNESS, a little to the north of the Wash, fully exposed to the east, is an important seaside resort for Lincolnshire.

HUNSTANTON, in **Norfolk**, on the southern side of the mouth of the Wash, has cliffs and sands facing almost due west towards Lincolnshire. It is a quieter place than Cromer, Great Yarmouth, and Lowestoft. CROMER is a favourite resort on the north-east coast of Norfolk, with pretty inland scenery in the neighbourhood and fine bracing cliffs (up to 200 feet) above the beach. To healthy persons who are fond of very breezy places, the open position of the hotel at the golf-links on the Lighthouse Hills to the east of the town will certainly commend itself. A few miles along the coast to the west of Cromer is SHERRINGHAM, a smaller place, with very fine scenery; and a few miles on the other

side (south-east) of Cromer are the quiet resorts of OVERSTRAND and SIDESTRAND. At HOLT, near Cromer, is the Kelling Sanatorium for poor consumptives. MUNDESLEY-ON-SEA, 8 miles south-east of Cromer, is a pretty place, with several hotels well situated on the sandy cliffs. About a mile inland from Mundesley, on the southern slope of a fir-crowned hill, which shelters it from sea winds, is the Mundesley Sanatorium for the treatment of pulmonary tuberculosis. GREAT YARMOUTH (latitude $52^{\circ} 36'$ north), about 18 miles east of Norwich, has a broad, flat, breezy sea-front and very extensive sands, with all the seaside features which attract excursionists. CAISTER-ON-SEA, a few miles to the north, and GORLESTON-ON-SEA, to the south of Yarmouth, have the same climatic advantages, and are, of course, less noisy. Mean July temperature at Yarmouth, 60.5° F.

LOWESTOFT (Suffolk), 10 miles south of Yarmouth, is an equally popular place, but less thronged by the excursionist. The mean temperature (1881-1900, according to F. C. Bayard) for January is 37.9° F.; for July, 60.1° ; for the year, 48.3° . The mean annual rainfall is 23.9 inches. Many pleasant excursions to the 'Norfolk Broads' can be made both from Lowestoft and Yarmouth. Further south on the Suffolk coast are the summer resorts of SOUTHWOLD, ALDEBURGH (or ALDBOROUGH), and FELIXSTOWE, with similar relatively dry bracing climates. Southwold and Aldeburgh are quiet resorts, about 12 miles apart, with the once famous town of Dunwich between them. Felixstowe, which has a rather more southerly aspect, is a bright well-frequented place with excellent golf-links and first-class hotel accommodation. Some of the best part of the health resort is about 80 feet above sea-level.

On the opposite side of the mouth of the Stour is the port of HARWICH (Essex), with its sea-bathing suburb, DOVERCOURT. Other resorts on the coast of Essex are WALTON-ON-THE-NAZE, FRINTON-ON-SEA, and CLACTON-ON-SEA, not far from Colchester, and SOUTHEND-ON-SEA, on the estuary of the Thames, close to Shoeburyness. Frinton, a relatively quiet place, has a sea-front of villas and hotels with a fine promenade separating them from the edge of the cliff, which here rises 100 feet or so above the foreshore. Clacton and Southend are often overcrowded with excursionists, the latter especially, as it is so easily and quickly reached by rail and steamboat from London. At low tide the expanse of muddy sand at Southend may be compared to that already mentioned at Weston on the Bristol Channel. The more elevated, western portion of Southend, the 'cliff town' as it is called, and the adjoining resort of WESTCLIFF-ON-SEA, are less crowded by one-day excursionists than the older lower town and the esplanade to the east of the remarkably long Southend pier.

SEASIDE RESORTS OF IRELAND

The coast climates of Ireland (latitude $51^{\circ} 30'$ to $55^{\circ} 20'$) are in general much more humid than the coast climates of England. The mean annual rainfall, except in the east around Dublin, varies from 30 to nearly 90 inches, and amongst the districts with great rainfall is that between Dingle Bay and Bantry Bay in the south-west of Ireland. It is at the border of this region of the coast, at the head of Bantry Bay, that Glengarriff, well known both as a winter and summer resort, is situated. Glengarriff and Queenstown, the two most generally recognised winter resorts of Ireland, are both in County Cork, and it is with the seaside resorts of this county that we will commence our summary, proceeding thence up the western coast, and so on around the whole island, ending with Waterford on the south coast. In regard to places in Ireland special help has been derived from the writings of Dr. D. E. Flinn.¹

QUEENSTOWN (latitude $51^{\circ} 52'$ north) is probably the best known and the liveliest winter resort of Ireland, and has a most beautiful situation on the south coast in Cork Harbour. It is built on the shore of Great Island, the houses rising in terraces from the harbour, facing south, and sheltered from the north and east. The climate is generally compared to that of Torquay in England. Mean temperature for the year, 51.9° F.; for winter, 44.2° ; for spring, 50.2° ; for summer, 61.8° ; for autumn, 52.8° . The mean annual rainfall is apparently only 34 inches. MONKSTOWN, GLENBROOK, and PASSAGE are pleasant places amidst beautiful scenery passed by the steamboats between Queenstown and Cork. BLARNEY, famous for its old castle and shady 'groves,' 7 miles inland from Cork, has a dry sandy soil and a mild climate. Mean temperature for the year, 51° F.; for the three winter months, 44.5° . The neighbouring hydrotherapeutic establishment of ST. ANNE'S HILL, situated in extensive grounds of its own, has good accommodation for invalids, and is one of the best known places of its kind in the United Kingdom.

YOUGHAL, about 1 hour by railway to the east of Cork, has an open sandy strand facing south-east on to Youghal Bay and suitable as a summer sea-bathing resort. The older portion of the town lies on Youghal Harbour.

GLANDORE, on Glandore Harbour, an inlet of the more western portion of the south coast, is remarkable for its picturesque scenery, and might develop into a regular health resort.

¹ See *Journal of Balneology and Climatology*, January 1897; and *Irish Health Resorts and Watering Places*, second edition, 1895.

GLENGARRIFF (latitude $51^{\circ} 45'$ north), on Bantry Bay, a large inlet of the south-western coast, is sheltered by mountains on the north and east and even on the west. As a winter resort it ranks with Queenstown, but is slightly warmer. Mean temperature for winter, 45° F.; for spring, 50.1° F. Its mean annual temperature is nearly 52° F., higher than that of Torquay, Falmouth, and Penzance, though just lower than that of the Scilly Islands (52.4° F.). Dr. J. A. Lindsay, speaking of Glengarriff, says: 'The arbutus blooms in the neighbourhood, and the flora witnesses to a degree of mildness unknown in other parts of the United Kingdom. The scenery is the most lovely in Ireland, and Bantry Bay, with its numberless inlets, merits higher praise than has ever been accorded to it.' The Glengarriff coast forms an 'Irish Riviera.'

PARKNASILLA (Kerry) is a new resort in a sheltered position on the northern shore of Kenmare Bay. Mean annual temperature, 52° F. Flinn draws attention to the special attraction of its combined mountain and woodland and water scenery. Other beautiful spots on the coast of Kerry are WATERVILLE, DINGLE, TRALEE SPA, BALLYBUNNION (at the mouth of the Shannon), and the island of VALENTIA, where the submarine cable across the Atlantic starts. At Valentia the mean temperature for the year is 51° F.; January, 44.4° ; July, 58.8° . Mean annual rainfall, 55.8 inches. Mean annual amount of bright sunshine, 1,488 hours (34 per cent. of the possible).

KILLARNEY, in Kerry, though some distance inland, may be mentioned here for convenience. The district in which it lies is much frequented by tourists, like the Lake district of Cumberland is, on account of the famous scenery of its lakes and mountains, its good hotel accommodation and facilities for boating, fishing, golfing, driving, &c. The climate is moist, equable, and mild, and the vegetation luxuriant. Mean temperature for the year, 50° F.; for January, 43.1° F.; for July, 58.7° F.

KILKEE, on the west coast (County Clare), is a favourite summer resort with good bathing facilities. It is built in a semi-circle facing a small bay of the Atlantic. KILRUSH lies on the estuary of the Shannon, on the southern side of the peninsula terminating in Loop Head, by which it is separated from Kilkee. These are great places for winds and waves. MILTOWN-MALBAY, north of Kilkee, is a good locality for sea-bathing and for fishing. LAHINCH, a little further north, was much frequented before Miltown-Malbay and Kilkee came into favour. The excellent golf-links now attract many visitors.

On the shores of Clew Bay are some summer resorts for bathing or fishing, WESTPORT, NEWPORT, and MILLARANY, not far from which is ACHILL.

In the north-west region, BUNDORAN, in Donegal Bay, is the best known resort, not far from Lough Erne and from the Donegal Highlands.

In the north of Ireland BUNCRANA, on Lough Swilly, is a pleasant summer resort with good accommodation. PORTRUSH, near the Giant's Causeway, is a very popular summer resort, and has a bracing breezy climate. PORT STEWART, a quieter place, 3 miles off, has a similar climate. There is likewise hotel accommodation, suitable for hot weather, on the cliffs close to the GIANT'S CAUSEWAY.

In the east of Ireland, BANGOR (County Down) is a quiet health resort on the southern shore of Belfast Lough. HOLYWOOD, situated between Bangor and Belfast, is practically a suburb of the latter town, being only 5 miles off. On the Castlereagh Hills, not far from Belfast and overlooking the Belfast Lough, is the Foster-Green Hospital for poor consumptives. DONAGHADEE lies on the coast of County Down, just south of Belfast Lough, 1 hour by railway from Belfast. NEWCASTLE, on Dundrum Bay, has an open situation at the north-eastern foot of the Mourne Mountains and is noted for the good excursions to be made in the neighbourhood. DUNDRUM itself can scarcely be called a health resort. KILKEEL is a quiet place on the coast between Dundrum Bay and Carlingford Lough.

ROSTREVOR and WARRENPOINT (County Down) are situated in picturesque country on Carlingford Lough. Warrenpoint is a summer resort with a good sea-front facing south-east and commanding a fine view on to the Lough, with the Mourne Mountains on one side and the Carlingford Mountains on the other. Rostrevor, on the north-east shore, and sheltered on the north and east by the Mourne Mountains, has, unlike Warrenpoint, some claim to be regarded as a resort for winter and spring as well as for summer and autumn. On the declivity of the Mourne Mountains, in a sheltered position amidst trees, at an elevation of about 350 feet above sea-level, and about 2 miles from Rostrevor and Warrenpoint, is the Rostrevor private sanatorium for the treatment of pulmonary tuberculosis.

In County Dublin MALAHIDE and HOWTH are seaside summer resorts to the north of Dublin Bay. KINGSTOWN, on the south shore of Dublin Bay, may be regarded as a seaside residential suburb of the Capital, from which it is only a few miles distant. Its harbour is the chief yachting station in Ireland, and there is good bathing. The accommodation is satisfactory, and the amusements of a great city are within easy reach. Mean annual temperature, about 50° F. The rainfall here, and in the whole region around Dublin, is the smallest in Ireland. In spring

easterly winds prevail, as at other places on the east coast. Close to Kingstown are the beautiful seaside resorts of DALKEY and KILLINEY.

BRAY, sometimes termed the 'Irish Brighton,' about 13 miles to the south of Dublin, is a very popular summer resort, with an open strand facing east and good bathing. It lies on the boundary between the counties of Dublin and Wicklow, not far from the beautiful scenery of the Wicklow Hills. Close by is Bray Head, a wooded promontory reaching about 650 feet above the sea (near which there is hotel accommodation); and a little further south is the quieter seaside resort of GREYSTONES. At NEWCASTLE (County Wicklow), not far from the coast, a few miles to the south of Greystones, is the Irish Royal National Hospital for Consumption (270 feet), with arrangements for the open-air treatment. The small 'Altadore Sanatorium' (Kilpedder) for pulmonary tuberculosis, in the fine scenery of the Wicklow Hills, is 5 miles distant from Greystones, and about 750 feet above sea-level.

Some inland localities not many miles from the coast may for convenience be mentioned here. The village of FENNISKERRY, in County Wicklow, $3\frac{1}{2}$ miles from Bray, is sheltered on all sides by wooded hills and has a mild equable climate. It is close to Powerscourt and the beautiful glen of the Dargle. DUNDRUM, nearer Dublin, has a sheltered position and mild climate suitable for residence in spring. WOODENBRIDGE, in the south of Wicklow, about 2 hours distant from Dublin, owing to its sheltered position, is likewise recommended for residence in spring. It is near Ovoca and some of the finest scenery of Wicklow.

On the coast of County Wexford, between Wexford and the south-eastern corner of Ireland, there is ROSSLARE, without much accommodation for visitors.

On the south coast we must still mention DUNMORE and TRAMORE, sea-bathing resorts not far from Waterford.

INLAND RESORTS OF GREAT BRITAIN

Amongst the inland health resorts we have to include :

(1) The 'spas,' that is, the mineral water health resorts : Bath, Buxton, Harrogate, Llandrindod, Strathpeffer, Woodhall, Droitwich, &c., one of which, namely Bath, has an important winter season.

(2) A number of localities, including the ordinary inland summer holiday resorts and several isolated hotels, offering visitors pure fresh country air and more or less satisfactory accommodation. They are scattered over different parts of the country at

various elevations above sea-level, and differ much in regard to their degrees of shelter from winds. The more bracing places have generally comparatively little shelter, and there is hardly any suitable accommodation to be obtained in Great Britain at much over 1,000 feet above sea-level. Many of the higher resorts (such as Braemar, Buxton, Hindhead, &c.), owing to their more northerly latitude and to the absence of much greater heights in the neighbourhood, exercise almost as bracing an effect on visitors as localities in the Swiss Alps with three times their elevation above sea-level, though the influence of the rarefied atmosphere of places of really high altitude is of course wanting in the English resorts, however bracing they may be in other respects. Moreover, the great amount of bright sunshine, one of the most important characteristics of really high altitude resorts, is not found in the elevated British resorts, which in this respect yield also (especially in late autumn and winter) to their relatively sunny neighbours on the coast. Braemar (1,100 feet), in Scotland, has, for instance, only 112·5 hours of bright sunshine in the three winter months (about 12 per cent. of the possible), whilst Aberdeen,¹ on the coast to the east, has 165·9 hours (about 23½ per cent. of the possible); Davos Platz, which may be taken as a type of Swiss high altitude resorts, is said to have during the same period about 300 hours of sunshine (57 per cent. of the possible); and Denver and Colorado Springs, in the Rocky Mountains of America, considerably more.

(3) The various sanatoria, both public and private ones, those for rich as well as those for poor or relatively poor patients, especially for patients suffering from pulmonary tuberculosis.

Amongst places possessing mineral waters,² some, such as Buxton, Tunbridge Wells, and Malvern, (furnished with brine from Droitwich), must be regarded not only as 'spas' (that is, as places frequented for the sake of their mineral waters), but equally, and in the last two instances much more, as climatic health resorts. Several climatic resorts possess likewise facilities for hydrotherapeutic treatment, and some of them, such as Ilkley, Ben Rhydding, Matlock, and Malvern, originally owed their reputation principally or in great part to hydrotherapy, that is to say, to their 'hydropathic' establishments or 'hydros.'³

Places where there are special facilities for invalids, such as Malvern and Buxton (health resorts proper), must be distinguished

¹ Averages given in the *Weather Reports of the Meteorological Office*, vol. xii.

² Under the term 'mineral waters' we include of course 'simple thermal' waters.

³ Cf. Part II, Chapter XII, footnote, on the use of the terms 'hydropathic' and 'hydro' in Great Britain.

from mere summer holiday resorts, where rest, relaxation, and open-air life are the only therapeutic factors. Great Britain is rich in the latter class of summer and autumn country resorts with abundant facilities for open-air exercises and pastimes, including walking, riding, driving, cycling, swimming, rowing, sailing, fishing, lawn tennis, golf &c. Not only are there many country villages and small towns which belong to this class of resorts, but there are also a number of more or less isolated hotels and 'hydropathics' in various parts of the country which may be included under this heading. We need only instance the hotels on Hindhead, near Haslemere, the Lake Vyrnwy and Elan Valley Hotels in Wales.

Those for whom especial quietude and seclusion are required should avoid the most frequented tourist resorts, and if constant medical supervision and attention are not necessary, may sometimes be advised to take lodgings or hire a cottage or farm-house out of the beaten tracks of ordinary tourists in preference to visiting a regular health resort.

Summer and autumn are the best seasons for nearly all the inland resorts of Great Britain, and very few of them are specially sheltered from the east winds of spring. The recently established sanatoria for the treatment of pulmonary tuberculosis are of course kept open all the year round.

In our survey of the inland health resorts of Great Britain we shall commence with the **spas**, and then consider the simple climatic and summer resorts.

BATH (100 to 600 feet), in Somersetshire, the 'Aquaë Solis' or 'Aquaë Sulis' of the Romans, has the only really hot springs in the British Islands, the waters of Buxton (82° F.) being tepid, and those of Matlock (68° F.), Bakewell (60° F.), the 'Hot-well' of Clifton and Bristol (73° F.), and Mallow in Ireland (70–72° F.), all being subthermal. The Bath waters have a temperature of 104° to 120° F., and though they contain as much as 1·3 parts of gypsum (sulphate of calcium) per mille, are, like most other thermal earthy waters, chiefly used externally, and best classified in the simple thermal group. It is interesting to note that the springs of Bath and Buxton were the first in which argon was discovered; the Bath waters likewise contain helium. Bath is situated in a pleasant district on the Avon, 11 miles to the west of Bristol. Much of the city is built in terraces on the hillsides, so that the houses have various elevations above sea-level. The surrounding 'downs' reach from 550 to 800 feet above sea-level; Lansdown to the north is 800 feet. Mean temperature¹ of the

¹ See *Climates and Baths of Great Britain*, 1895, vol. i. p. 517.

air at Bath for summer, 60·3° F.; for autumn, 50·7°; for winter, 41·4°; for spring, 48·4°; for the year, 50·5°. Mean annual rainfall, 32 inches. In the eighteenth century Bath was a very fashionable resort, and afterwards was for a time neglected. It is now much frequented again, and has an important winter season. The indications are all those for simple thermal waters in general, and all those for special methods which have been introduced at Bath, such as the douche massage of Aix-les-Bains, the effervescent baths and exercises of Nauheim, local and general hot vapour and air baths (including the so-called 'radiant heat baths' with electric lights), &c. A crane-chair is employed for lowering patients with stiff joints into their baths. At LIMPLEY-STOKE, about 6 miles to the south-east of Bath, is a 'hydropathic.'

BUXTON (1,000 feet), in a broad shallow valley of a high part of the Derbyshire Peak District, is one of the most bracing health resorts of Great Britain, and ordinary visitors besides invalids are attracted by the good air and the interesting excursions to be made in the neighbourhood. Its simple thermal water (82° F.), with only about 0·4 per mille of solids, has, like many waters of this class in various parts of the world, a large proportion of nitrogen gas in solution; argon forms about 2 per cent. of the total gases. The baths are given at the natural tepid temperature of the water for 4 to 7 minutes, or, as in the case of persons with enfeebled power of resistance, they can be artificially heated. There are likewise facilities for various hydrotherapeutic procedures, massage, electric light baths &c. The Devonshire Hospital enables many patients of the poorer classes from various parts of England to obtain the advantages of the Buxton thermal treatment and the Buxton climate. The season is from April to September, but the health resort is kept open all the year round. The mean atmospheric temperature (1881-1900, according to F. C. Bayard) for January is 34·9° F.; for July, 57·3°; for the year, 45·2°. The mean maximum and mean minimum temperatures for July are given as 65·7° F. and 48·9° F. The mean annual rainfall averages 49·17 inches.

The Peak District abounds in places which are visited for their pure air, fishing, beautiful scenery, and interesting excursions. Most of these can be classed as simple summer holiday resorts. MATLOCK BATH (300 feet), BAKEWELL (400 feet), and STONEY MIDDLETON have subthermal waters of quite secondary interest. MATLOCK consists of different portions—Matlock Bath, Matlock Bridge, Matlock Village, and Matlock Bank, situated in the beautiful Derwent Valley and on its slopes. Smedley made Matlock noted for its hydrotherapeutic treatment, and it contains

a number of 'hydropathics,' some of which are in considerably higher and more open and more bracing positions than Matlock Bath. BASLOW, near Chatsworth Park, likewise possesses a 'hydropathic.'

DRITWICH, celebrated for its brine baths, lies amidst pleasant country in Worcestershire, though the old town itself is not beautiful. The waters of Droitwich, in England, Rheinfelden, in Switzerland, and certain other places in various parts of the world, are practically saturated brines having a specific gravity of about 1.200, and containing about 31 per cent. of common salt, that is, about ten times as much as ocean water. Such waters may be compared to those of various inland seas and lakes, which, owing to constant evaporation and the absence of any outlet, gradually become more and more concentrated solutions of salt.¹ The Droitwich brine baths, heated by steam and thus only very little diluted, or diluted and heated as required, are used in cases of chronic muscular rheumatism, sciatica, neuralgias &c. The brine is likewise used for swimming baths, and is also supplied to Malvern, a health resort which will be referred to later on.

NANTWICH (about 120 feet), in a pleasant well-wooded district in Cheshire, has strong brines containing about 21 per cent. common salt (rather less concentrated than those of Droitwich). There are likewise brine baths at MIDDLEWICH, in Cheshire, and at STAFFORD. It may be noted that at Northwich, the centre of a rich salt district in Cheshire, the pumping-out of enormous quantities of brine for commercial purposes has, as at Droitwich, led to subsidence of the ground at certain spots.

WOODHALL SPA, in Lincolnshire, and ASHBY-DE-LA-ZOUCH, in Leicestershire, have much weaker brines (about 2 per cent. common salt) than those of Droitwich and Nantwich. The Woodhall waters, in addition to common salts, contain small quantities of the chlorides of calcium and magnesium, and of bromides and iodides. Woodhall Spa has good bath arrangements and is visited for rheumatoid arthritis, muscular rheumatism, scrofulous complaints, leucorrhœa &c. A mother-lyè (German, 'Mutterlauge') is made from the Woodhall brine, and can be used, like that of Kreuznach, for local compresses or for strengthening the baths. Woodhall Spa is only about 40 feet above sea-level, and lies amidst a nearly level kind of moorland bordering the fens, about 23 miles due west of the little seaside resort of Skegness. The climate is under the influence of sea-breezes, and, like that of the east coast generally, is bracing. The Scotch firs and woodland in the neighbourhood contribute to the

¹ See the footnote on Droitwich and other concentrated brines in Part II, Chapter XVIII.

healthiness of the locality. Though by many it would be called a dull place to stay at, others are likely to be well suited there. The accommodation is satisfactory, and for those who are fit there are excellent facilities for golf, cycling, lawn tennis &c.

HARROGATE, in the West Riding of Yorkshire, 18 miles by railway to the north of Leeds, is perhaps at present the most flourishing English mineral water health resort. It has a bracing position on an uneven plateau amongst the Yorkshire moors, about half-way between the Irish Sea and the North Sea, at 350 to 600 feet above sea-level.¹ Some of the most bracing sites are those of the hotels and houses in the upper town (High Harrogate), which border a large tract of common ground called the 'Stray.' The lower town (Low Harrogate) is more sheltered and less bracing. Of the large number of mineral springs, the best known belong to the cold muriated sulphurous group, containing common salt, sulphuretted hydrogen, and sodium sulphide, and the one generally preferred for internal use is the Old Sulphur Well. The bath arrangements are modern. The indications for Harrogate are those for this class of mineral waters, for a bracing climate, and for the various kinds of balneotherapeutic and electrotherapeutic treatment to be obtained, including the Aix douche-massage, hot-air and vapour baths, D'Arsonval high frequency currents &c. The average annual rainfall is 30.16 inches and the average number of rainy days 188. The average annual sunshine for the past six years is said to amount to 1,796 hours.

LLANDRINDOD WELLS, in Radnorshire, the most flourishing inland health resort of Wales, lies in the centre of an elevated plateau, to some extent protected towards the east by Radnor Forest. Of the central Wales group of spas, comprising Llandrindod, Llanwrtyd, Llangammarch, and Builth, the upper portion of the first resort, owing to its open situation and rather bare surrounding country, can doubtless claim the most bracing climate, Llangammarch coming next. The altitude of the upper portion of Llandrindod, with the Pump House Hotel, is 700 feet; the Rock House Hotel has a lower and less bracing situation, but would be of service to delicate persons requiring shelter from winds, especially during the earlier and later periods of the year. The Llandrindod waters are chiefly employed internally, and may be divided into three groups: (A) Muriated waters, containing 3.4 to 4.8 per mille common salt, 1.0 to 1.4 chloride of calcium, 0.04 to 0.7 chloride of magnesium. (B) Muriated sulphurous waters, analogous to those of Harrogate, containing, in addition

¹ The Royal Pump Room is about 350 feet above sea-level, 'High Harrogate' reaches to 500 feet, and the top of Harlow Hill is 600 feet exactly.

to a little common salt, 1 to 14 volumes per mille of sulphuretted hydrogen. There is likewise a fairly pure sulphurous spring, analogous to that at the neighbouring spa of Llanwrtyd. (C) Weak, non-gaseous chalybeate waters, of quite secondary importance. All the springs of this spa are cold. Llandrindod is largely resorted to by persons suffering from the effects of sedentary habits, mental fatigue, and a too copious or stimulating diet, including a variety of gouty, rheumatic, and digestive disorders. The season is from May to October.

LLANWRTYD WELLS, in Brecknockshire, has a higher elevation (800 feet) than Llandrindod, to which it ranks second in importance amongst Welsh spas. It is, however, more sheltered and less bracing than its more frequented neighbour. The chief Llanwrtyd spring is a fairly pure representative of the sulphurous group; it has been found to contain 36 volumes per mille sulphuretted hydrogen. There is likewise a weak non-gaseous chalybeate spring, and the muriated waters of Builth can also be obtained at Llanwrtyd. The chief accommodation is at the Dolecoed Hotel, situated in a pleasant park close to the springs, and on the most sheltered (western) side of the town.

BUILTH (400 feet), a market town to the south of Llandrindod, pleasantly situated on the Wye, in a broad sheltered valley, has a less bracing climate than its neighbours, Llandrindod, Llanwrtyd, and Llangammarch. In its various 'wells,' not far distant, it possesses waters similar to those of Llandrindod, but the muriated waters of Builth are rather more highly mineralised.

LLANGAMMARCH WELLS (about 600 feet), between Builth and Llanwrtyd, has a weak muriated water with a total mineralisation of 4·3 per mille, including small amounts of common salt, calcium chloride, magnesium chloride, and barium chloride (0·096 per mille). The Llangammarch water has been termed 'barium water,' owing to the importance attached by some to the presence of the barium salt. For internal use it may be taken still or artificially charged with carbonic acid gas. The place is situated at the southern foot of a range of hills, in a wide valley, to some extent sheltered on the north and east. The climate is bracing.

STRATHPEFFER (150–350 feet), the chief mineral water resort of Scotland, has a sheltered position in a broad valley of Ross-shire, and, considering its northerly latitude (57° 36' north), has a mild climate. Its chief springs are cold sulphurous, the Morrison Well being said to contain about 0·027 per mille sulphides of potassium and sodium, and about 40 volumes per mille of sulphuretted hydrogen. The Lady Cromartie Well is said to be still more sulphurous. There are likewise non-gaseous chalybeate waters. The indications for Strathpeffer are those for cold sulphurous

waters and a fairly mild climate. The place is sometimes resorted to by visitors from tropical countries, when more bracing localities are unsuitable. The higher parts of Strathpeffer have, of course, a somewhat different climate to the parts lower down in the valley.

MOFFAT (about 370 feet), in Dumfriesshire, in the upper part of the broad Vale of Annan, has considerable shelter from north and east winds. The cold sulphur well, about $1\frac{1}{2}$ miles distant, contains about 5.3 per mille volumes of sulphuretted hydrogen gas. The water of the 'Hartfell Spa,' about 4 miles from the town, belongs to the sulphate of iron group. The air is pure, and the little town clean and attractive. The 'hydropathic' affords facilities for ordinary hydrotherapeutic treatment. There are many pleasant excursions to be made in the neighbourhood.

Amongst other places in Great Britain with sulphurous waters we may mention: ASKERN SPA, in Yorkshire, not far from Doncaster; DINSDALE-ON-TEES, in Durham, not far from Darlington; and GILSLAND SPA, a quiet resort in Cumberland, about 20 miles from Carlisle, situated on the river Irthing, in hilly picturesque country, with beautiful woodland walks. Gilsland likewise possesses chalybeate waters.

TUNBRIDGE WELLS (about 420 feet), in Kent, was formerly chiefly visited for its chalybeate water, which contains about 0.06 per mille carbonate of iron, but as it is very poor in free carbonic acid gas, cannot be ranked with the chalybeate waters of Spa in Belgium, Schwalbach in Germany, &c. The place is now a climatic resort much visited by convalescents &c. during the summer months. The soil is porous, and the climate bracing and fairly dry. There are facilities for hydrotherapy. The mineral water spring and the old-fashioned arcade of shops, termed the 'Pantiles,' are situated in a hollow, but most of the hotels are situated on high ground in much more bracing positions, many of them bordering the open common. SOUTHBOROUGH and FRANT, not far from Tunbridge Wells, may be used as quieter summer resorts with little hotel accommodation. CROWBOROUGH, likewise in this neighbourhood, is mentioned further on.

There are a good many other non-gaseous chalybeate springs in Great Britain. Some of them, such as those at Harrogate, Llandrindod, and Shanklin, have already been referred to. TREFRIW, situated in the beautiful Vale of Conway, in North Wales, has sulphate of iron waters. The sulphate of iron waters of FLITWICK WELL, near Ampthill, in Bedfordshire, are sold in bottles.

LEAMINGTON (about 200 feet) is situated close to Warwick, in one of the most historically interesting districts of England. The

country around is somewhat level, but highly cultivated and 'leafy,' and the climate moderately bracing. Mean annual rainfall, about 30 inches. The waters contain small quantities of common salt and of the sulphates of sodium, magnesium, and calcium, and in most persons exercise an aperient influence. The town is a particularly pleasant one owing to its well-built houses being amply interspersed with gardens and trees, and it is often selected for permanent residence by persons who have retired from their professions. Its hygienic arrangements are satisfactory. It contains good schools. The facility for visiting Warwick, Kenilworth Castle, Stratford-on-Avon &c. is one of the attractions of a stay at Leamington, which is open all the year through, and is likewise a hunting centre.

CHELTENHAM (about 150 feet) is a flat town in the Severn Valley, sheltered from east winds by the Cotswold Hills. It possesses somewhat similar waters to those of Leamington, and likewise non-gaseous chalybeate waters, but the place has for many years been hardly used for a spa. It is a healthy town, with a sheltered, though not relaxing, climate, and is frequently chosen as a place of permanent residence by old Indians &c. The educational facilities are excellent. There are good golf links (on Cleeve Hill). Mean temperature for the year (according to F. C. Bayard, 1881-1900), 48·4° F.; for July, 61° F.; for January, 37·6° F. Mean annual rainfall, 26·39 inches, with 186 rainy days.

Most of the **remaining inland health resorts** of Great Britain do not possess mineral waters. In considering them we shall commence with the south-west and south of England, and work up towards the north.

The heights of **Dartmoor** and **Exmoor**, consisting of undulating moorlands, have cold and bracing climates, and are much exposed to winds. On Exmoor little accommodation can be obtained, but on and around Dartmoor (mean elevation of Dartmoor is about 1,500 feet) there is hotel accommodation at PRINCETOWN (1,400 feet), noted for its large convict prison, and at the lower elevations of MORETON-HAMPSTEAD, LIDFORD, CHAGFORD, OKEHAMPTON, &c. Several of the isolated hotels scattered about on Dartmoor have elevations of over 1,000 feet above sea-level. Near Chagford is a private sanatorium (750 feet) for the treatment of pulmonary tuberculosis, sheltered from south-west and east. According to meteorological observations at Princetown on Dartmoor,¹ the mean temperature for the year is 45·6° F.; for July, 58·6°; for January, 36·5°; and lower still for February and March. Mean annual rainfall, about 72 inches, with about 209 rainy days.

¹ *Climates and Baths of Great Britain*, 1895, vol. i. p. 77.

On the **Mendip Hills** private sanatoria for the treatment of pulmonary tuberculosis have been established. At **NORDRACH-UPON-MENDIP** protection from winds is afforded by the woods of beech and fir trees which nearly surround the sanatorium. The nearest railway station is Blagdon. **HILL GROVE** ('Mendip Hills Sanatorium') is situated in extensive grounds of fir and larch plantations. Near **PORTBURY**, on an outlying spur of the Mendip Hills, is the 'Luftkur Sanatorium' (450 feet above sea-level) for the open-air treatment of pulmonary (and laryngeal) tuberculosis. It is sheltered from the prevailing south-west winds. At the southern foot of the Mendips, between Cheddar and Axbridge, is **St. Michael's Home**, a sanatorium for consumptive poor from London and other cities. Further to the west, on the **Quantock Hills**, between Exmoor and the Mendips, is the little **Timbercombe Sanatorium** (about 750 feet), near Bridgwater.

CLIFTON, though a suburb of the large city of Bristol, must, with the **Clifton and Durdham Downs** (230 to 310 feet), be considered an important climatic health resort, especially for spring and autumn. The country is beautiful and healthy, and the climate moderately bracing. The 'Hot-well' spring (73° F.) was formerly in great repute.

MALVERN, in Worcestershire, is one of the most important inland climatic resorts of Great Britain. **GREAT MALVERN** has an altitude of about 520 feet, but some of the houses are considerably higher. It lies on the eastern declivity and foot of the **Malvern Hills**, a range running north and south, attaining a height of 1,440 feet at the highest point, the Worcester Beacon, above Great Malvern. **MALVERN WELLS** and **LITTLE MALVERN** are likewise on the eastern side of the range, 2 and 3 miles respectively to the south of Great Malvern; **NORTH MALVERN** lies on the northern slope; whilst **WEST MALVERN** is situated on the opposite (western) side to Great Malvern, but at a somewhat higher altitude. **St. Anne's Well** and the **Holy Well** yield very pure water, formerly supposed to possess peculiar virtues. Malvern has many 'hydropathics,' and is one of the chief English places for hydrotherapy. **Droitwich** brine baths can likewise be obtained. Great Malvern and the neighbourhood are much visited by invalids for whom a rather bracing dry inland climate is required; the place is open not only during summer, but also during spring and autumn and even winter. There are excellent educational facilities at Malvern.

In the hills near **Marlborough** and **Newbury** are some healthy sites which might serve for sanatoria.

The **New Forest**, a district in Hampshire to the west of Southampton Water, is still a well-wooded country, and beautiful,

though relaxing to some persons. It is often suitable between May and October, inducing visitors to lead a healthy open-air life. There is hotel accommodation at **LYNDHURST** and near **BROCKENHURST**. Near **RINGWOOD**, in a pleasant position on the western border of the New Forest, is the **Linford Sanatorium** (160 feet), a private sanatorium for the treatment of pulmonary tuberculosis, about 10 miles or so to the north of Bournemouth.

In the **Cotswold Hills**, a more bracing region, at an elevation of about 800 feet above sea-level, is the **Cotswold Sanatorium**, a private sanatorium for pulmonary tuberculosis, standing in grounds of its own, well furnished with fir and beech, and commanding magnificent views over the Severn Valley and in other directions. It is about 7 miles both from Cheltenham and from Stroud.

Further south in the Cotswolds, on the other side of Stroud, is **Minchinhampton Common**, an extensive open grassy tableland, about 380 feet above sea-level, surrounded by beautiful valleys, and known for its invigorating breezes, its facilities for golfing, and the charming views afforded in all directions (over the Severn Valley, the Woodchester Valley, &c.). It may serve as a bracing inland locality for convalescents, overworked persons &c. The little town of **MINCHINHAMPTON**, at the southern edge of the Common, and the village of **AMBERLEY** (more picturesque), above Woodchester, on the western edge, afford a certain amount of accommodation for visitors. Some of the houses on the Amberley slope have shelter from the east and north.

We now arrive at the places to the south of (and on the banks of) **the Thames**, amongst which we will first mention some of the more low-lying localities for various reasons suitable as summer resorts.

Many of the towns and villages on and near the banks of the Thames, between London and Oxford, are frequented during the summer months on account of their beautiful river scenery, and on account of the facilities for leading a pleasant open-air life, with boating, &c. Amongst them (proceeding along the river in a downward direction) we need only mention **HENLEY** (famous for its annual regatta), **GREAT MARLOW**, **COOKHAM**, **TAPLOW**, **MAIDENHEAD**, **WINDSOR**, **DATCHET**, **EGHAM**, **STAINES**, **WEYBRIDGE**, **THAMES-DITTON** and **SURBITON**, **KINGSTON-ON-THAMES**, **TEDDINGTON**, **TWICKENHAM**, and **RICHMOND**. Windsor and Richmond have the combined attractions of the river for boating and their magnificent parks for walking and riding exercise. Similarly, Datchet, Egham, and Staines are all near Windsor Park and Virginia Water as well as near the river; and Weybridge (with **OATLANDS PARK**) is close to the beautiful wooded

walks of St. George's Hill.¹ The localities mentioned in our list after Thames-Ditton and Surbiton are now practically residential suburbs of London, known (like some of the places in the following paragraph) as the homes of very many whose occupation obliges them to come frequently to town.

To the south of the Thames, in the counties of Kent and Surrey, we may mention a number of towns and villages mostly situated at the foot or on the slopes of hills connected with the **North Downs**: CHISLEHURST, SEVENOAKS, EPSOM, REDHILL, REIGATE, DORKING and BURFORD BRIDGE, GUILDFORD, GODALMING, CRANLEIGH, FARNHAM, and HASLEMERE. These places present different degrees of shelter from winds, and mostly lie in valleys or on low ground, though relatively elevated and bracing spots may be found amongst them, such as the upper portion of Chislehurst, in an open situation nearly 340 feet above sea-level, and Sevenoaks and Haslemere, both about 500 feet in altitude. They are all suitable as summer resorts on account of the beautiful and healthy country amidst which they are situated, and the variety of walks on level or hilly ground in the neighbourhood.

At nearly all the places mentioned in the preceding paragraphs there is good or tolerable hotel accommodation to be had, and at most of them (as well as in the open country around them) there are private houses, cottages, or lodgings which can be hired for a season. In the more elevated and bracing situations, however, there are scarcely any good hotels as yet. **Hindhead** (highest point just over 900 feet), near Haslemere, is a notable exception in this respect, for on its broad back, where there are already numerous private residences, hotel accommodation has been provided in an open and very bracing situation, about 820 feet above sea-level.

In the elevated and bracing regions of the **South Downs** there is as yet very little public accommodation for visitors, but between the North Downs and the South Downs, at **TUNBRIDGE WELLS** and at **CROWBOROUGH**, 7 miles from Tunbridge Wells, there are hotels in elevated bracing situations, as already mentioned under Tunbridge Wells. Crowborough, which may be regarded as part of the eastern margin of **Ashdown Forest**, consists of various portions, scattered over a considerable area, amidst the meadows, heaths, cornfields, and small woods (clumps of firs and other trees) of one of the most beautiful districts of

¹ St. George's Hill comprises an extensive area, rising to 520 feet above sea-level, and thickly wooded with pines and other trees. It is private property, but the walks are open. Could certain sites be obtained, it would constitute an almost ideal place for the establishment of sanatoria for consumptives near London.

England. Crowborough Cross, Crowborough Green, Crowborough Beacon, and a great part of Crowborough Common, are situated on a broad irregular ridge 650 to 800 feet above sea-level, but the portion of Crowborough near the railway station to the south-east and the land to the north-west are 300 or 400 feet lower than the highest parts. At Crowborough Beacon in a breezy and bracing position (800 feet) there is first-class hotel accommodation. On the slopes of Crowborough Common are some excellent sites with a certain amount of shelter from the north and east. To the west, in the Ashdown Forest direction, new roads are being made and new residences are springing up.

Though there may be difficulties in regard to accommodation, there is certainly no lack of healthy bracing sites in the counties south of the Thames, amongst the North Downs and scattered hills, which can be easily reached from London. As affording such sites we need only mention the following: HOLLINGBOURN HILL (600 feet); the hills near SEVENOAKS, REIGATE, and DORKING, including the neighbourhoods of BOX HILL (590 feet), LEITH HILL (965 feet), and HOLMBURY HILL (800 feet), with COLDHARBOUR (about 750 feet) and other places in the Leith Hill district; the EPSOM and BANSTEAD DOWNS; the CHOBHAM RIDGES; the HOG'S BACK (350 to 500 feet); HINDHEAD (with good accommodation, already referred to) and BLACKDOWN HILL (about 900 feet), both near Haslemere. On the southern slope of EASEBOURNE HILL, in the north-western part of Sussex, not far from Midhurst and Haslemere, is the KING EDWARD VII SANATORIUM for consumptive patients of limited means. It stands at an elevation of about 500 feet, sheltered on the north and east by pinewoods and rising ground, and commanding a fine view towards the south of a broad fertile valley and the South Downs. Its beautiful grounds are well adapted for graduated walking exercise. On the Chobham Ridges, not far from Frimley and Camberley, is the Heatherside Sanatorium (400 feet) of the Brompton Hospital for Consumption; it lies amidst pines to the north of a large open common, over which there is a view towards Farnborough and Aldershot. On the CROOKSBURY RIDGES, to the south of the Hog's Back, near Farnham, the Crooksbury Sanatorium (400 feet) for the treatment of pulmonary tuberculosis has a fine position in a region abounding with pine-woods; in the same neighbourhood is the Whitmead Hill Sanatorium (about 300 feet), another private sanatorium for the treatment of pulmonary tuberculosis.

Amongst suitable localities not yet mentioned in the counties south of the Thames (accommodation various: hotels, or else houses or cottages to be hired) are: ASCOT, in Berkshire, and BAGSHOT,

FRIMLEY, and FARNBOROUGH in the adjoining portion of Surrey; the neighbourhood of MERROW, near Guildford, and HOLMWOOD, near Dorking; BANSTEAD, near Epsom; OXTED, LIMPSFIELD, and WESTERHAM, between Redhill and Sevenoaks; BURGESS HILL, EAST GRINSTEAD, THREE BRIDGES, CUCKFIELD, HAYWARD'S HEATH, MAYFIELD, and MIDHURST, in Sussex; LIPHOOK, SELBORNE, LISS, and PETERSFIELD, in Hampshire. In Hampshire, 2 miles from Medstead station, is 'Broadlands,' a small summer sanatorium suitable for persons exhausted by town life &c. In Berkshire, near Wokingham and Wellington College, is PINESWOOD, the 'London Open-air Sanatorium' for the treatment of early cases of pulmonary tuberculosis. It was opened in 1901, and stands on sandy soil, in a plain about 220 feet above sea-level, surrounded on all sides by a pine forest, which affords considerable shelter against winds. BOARS HILL is a healthy locality for residence near Oxford.

In Essex, to the north-east of London, are CHINGFORD and other places in the beautiful and healthy neighbourhood of **Epping Forest**; this district is generally regarded rather as a popular holiday playground for Londoners than as a climatic resort for the summer months.

To the **north-west of London**, NORTHWOOD, RICKMANSWORTH, CHENIES, and HARROW lie in pleasant country, and are suitable for a stay in summer. At NORTHWOOD (370 feet) is the beautiful country branch of the Mount Vernon Hospital for Consumption, Hampstead, and it may likewise be noted that the original hospital at Hampstead, which has lately been much enlarged, has, unlike most town hospitals, an excellent position, about 300 feet above sea-level, close to Hampstead Heath and to the south-west of slightly higher ground, which affords some shelter from north and east winds. WATFORD (Hertfordshire) is a pleasant residence for persons whose business is in London. Close by is BUSHEY, with facilities for hydrotherapy (as well as for golf and lawn tennis), and between Bushey and Stanmore is BENTLEY PRIORY. In Hertford, to the north of Watford and Hemel-Hempstead, is the village of FLAMSTEAD, situated on an eminence 500 feet above sea-level, which, according to Dr. S. D. Clippingdale, has an old-established reputation as a healthy place for weakly children.

On the western declivity of the southern part of the **Chiltern Hills** there is a small sanatorium (380 feet) for the open-air treatment of pulmonary tuberculosis. It is situated near the village of Hailey, not far from Goring-on-Thames and Wallingford, and its grounds have an elevation of 300 to 400 feet above sea-level.

WOBURN SANDS and ASPLEY GUISE, in Bedfordshire, about 40 miles to the north-west of London, have beautiful and healthful situations, though at present they lack accommodation for invalids to make them actual health resorts. The houses of these adjoining little towns are scattered over a rather large area, on the slopes of well-wooded hills, at elevations of 400 to 500 feet above sea-level. There is a good deal of shelter from the east and north-east winds; but the difference between the various groups of houses is as considerable in this respect as it is in regard to altitude. Some of the dwellings on the high ground known as 'Aspley Heath' have only the adjoining forest to shelter them. The woodland walks (notably those in the pine-woods) in the immediate neighbourhood may be enjoyed by all, and the magnificent park (likewise open to the public) of Woburn Abbey is only about 3 miles distant. The soil of the district is dry and porous. According to the statistics quoted in Horton-Smith-Hartley's article¹ on the Midland Counties, the annual rainfall at Aspley Guise is 23·4 inches, distributed over 166 days; the mean annual relative humidity is 82·8 per cent. of saturation; and there are 1,385·9 hours of sunshine in the year, 29·6 per cent. of the possible duration. The mean temperature for the year is 47·5° F.; for July, 60·6° F.; for January, 36·7° F.; mean daily range for the whole year, 14·4° F. At Woburn Sands is the 'Daneswood Sanatorium' for poor consumptive Jews.

Near NAYLAND, in Suffolk, in a good situation, is the new EAST ANGLIAN SANATORIUM for consumptives.

CHURCH STRETTON, a pleasant village in a broad valley of the hilly country of South Shropshire, about 700 feet above sea-level, attracts many visitors, owing to its reputation for pure health-giving air and for the bracing effect of exercise on the adjoining hills. There is modern hotel accommodation.

In **Delamere Forest**, at Roughhill, Kingswood, to the east of Chester, is the Liverpool Sanatorium for the open-air treatment in connection with the Liverpool Hospital for Consumption. In the same Forest, about 420 feet above sea-level, and half a mile from the Liverpool sanatorium, is the Crossley Sanatorium (opened 1905) of the Manchester Hospital for Consumption. • Leeds has a sanatorium for poor consumptives in a beautiful estate (Gateforth Hall) about 5 miles from Selby.

At the southern end of **Sherwood Forest**, between pinewood and moorland, at an altitude of 470 feet above sea-level, is the 'Nottinghamshire Sanatorium,' opened in 1902 for the treatment

¹ *The Climates and Baths of Great Britain*, vol. ii. p. 159.

of consumptive persons of limited means. It is about 3 miles to the east of Mansfield.

ILKLEY WELLS (Ilkley in **Wharfedale**), in Yorkshire, 13 miles from Leeds, came into fame as a health resort on account of the hydrotherapy first introduced by Dr. Macleod at the establishment of **BEN RHYDDING** (500 feet above sea-level), about 1 mile distant. The numerous hydropathics at Ilkley were established afterwards. The situation of these places in the beautiful valley of the Wharfe, their bracing climate, and the pleasant walks and numerous interesting excursions have made them very popular resorts. At **SHOTLEY BRIDGE** (about 500 feet), on the river Derwent, in the county of Durham, near the boundary between Durham and Northumberland, is the small 'Bellevue Sanatorium' for the open-air treatment of chest diseases. **ROTHBURY**, in Northumberland, has a pleasant position in the Coquet Valley, sheltered from the north-east and bordered on the west by spurs of the Cheviot Hills. Its claims as a summer resort are advocated by Dr. William Murray, who even compares the climate of this region to that of the country north of Aviemore and Kingussie in the Scotch Highlands.

The **Lake District** in the north-west of England, occupying parts of the counties of Cumberland, Westmoreland, and Lancaster, may be compared to the Lake District of Killarney, in Ireland. Both are mountainous districts, situated near the western coast, and therefore possessing unusually rainy climates. Both are districts where fatigued and overworked persons may spend a delightful holiday in the pursuit of health combined with pleasure. The resorts in these districts, though situated amidst mountains, are not very elevated, and are somewhat sedative; but they have the great attractions of beautiful scenery, interesting walks, climbing, boating, fishing &c. Amongst the resorts of the English Lake District we may mention **KESWICK**, **GRASMERE**, **AMBLESIDE**, **BOWNESS**, **WINDERMERE**, **CONISTON**, **ULLSWATER**; and in the peninsula of Furness, **FURNESS ABBEY** and the 'hydropathic' of **CONISHEAD PRIORY**.

Wales has a good many inland places suitable for spring, summer, and autumn. We have already mentioned **Llandrindod**, **Llangammarch**, and **Llanwrtyd** in Central Wales amongst the spas. Of the remaining places which can be named as resorts for exercise in pleasant country with good air and mental recreation, the following are amongst the more bracing: **LLANBERIS**, **PEN-Y-GWRYD** (900 feet), **CAPEL-CURIG**, and **BEDDGELERT**, in the Snowdon district; **FESTINIOG-VILLAGE**, in an open situation a few miles from the great Festiniog quarries; the **LAKE VYRNWY HOTEL** (about 1,000 feet), on the banks of the large reservoir which supplies Liverpool with water; and the **ELAN VALLEY HOTEL**,

near the reservoir which supplies Birmingham with water. Less bracing places are : TREFRIW, LLANRWST, and BETTWS-Y-COED, in the beautiful Vale of Conway; LLANGOLLEN, in a beautiful valley on the Dee, a great resort for fishing and centre for excursions (the surrounding slopes could be adapted for the 'Terrain-Cur'); and DOLGELLY, in mountainous country to the north of Cader Idris. BALA, at the north end of the Bala Lake, between Dolgelly and Llangollen, lies (600 feet) somewhat higher than either of these places. On the eastern (Flintshire) side of the VALE OF CLWYD, near Ruthin, is the 'Vale of Clwyd Sanatorium' (450 feet) for consumptives.

Of the more southern localities in **Scotland**, PEEBLES and INNERLEITHEN, in the county of Peebles, are pleasantly situated on the 'Tweed, about 6 miles from each other. The former has a well-known 'hydropathic,' and the latter has weak muriated waters.

Further north, between the Firth of Clyde on the west and the Firths of Forth and Tay on the east, are Inversnaid, The Trossachs, Callander, and other resorts of the south-western 'Highlands;' also Bridge of Allan, Bridge of Earn, and Crieff. INVERNAID is one of the most beautiful spots on Loch Lomond, the largest lake in Scotland; but there are likewise other beautifully situated hotels on Loch Lomond, and one (Stronachlachar) on Loch Katrine, a much smaller lake, but quite as beautiful. THE TROSSACHS, that is the name given to the wooded country to the east of Loch Katrine, gives its name to another good hotel of this neighbourhood. All these places are much visited on account of the magnificent lake and mountain scenery of the south-western Highlands. CALLANDER and ABERFOYLE are tourist centres not far distant from the Trossachs.

BRIDGE OF ALLAN, 13 miles to the south-east of Callander, has a sheltered position in a picturesque country at the south-western foot of the Ochill Hills and partly on the hillside, about 40 to 200 feet above sea-level; it is 3 miles to the north of Stirling, with which it is connected by railway and tram. Its weak muriated waters, containing chlorides of sodium and calcium, have an aperient action in some persons. It has a relatively mild winter climate, and has been compared to Cheltenham, in England. Bridge of Allan and DUNBLANE (3 miles distant) both have 'hydropathics' on relatively elevated sites. The walks in the woods near these places are very fine. On the southern declivity of the OCHILL HILLS there is a private sanatorium for the treatment of tuberculosis, amidst well-wooded surroundings, about 800 feet above sea-level, 4 miles from Kinross, which was opened in 1902. It is sheltered by the Ochill Hills on the north, and towards the south commands a magnificent view of Loch Leven with Benarty Hill and the whole

country around. **BRIDGE OF EARN** (about 30 feet), situated on the Earn, in a broad valley 4 miles from Perth, has the muriated 'Pitkeathly' waters. **CRIEFF** lies at the declivity of the Grampians, between the Highlands and Lowlands, amidst well-wooded surroundings, about 10 miles to the west of Perth. It has a well-known 'hydropathic.' At **Auchterhouse** on the **SIDLAW HILLS**, in a sheltered position to the east of the Perthshire Highlands, is the **Sidlaw Sanatorium** for pulmonary tuberculosis, 800 feet above sea-level.

We now come to resorts in the **more northern Highlands**, most of which lie at a considerable relative elevation above sea-level, near 'Scotch moors,' and have a decidedly bracing climate. **PITLOCHRIE** (Perthshire), one of the most esteemed summer resorts of Scotland, is situated on the Tummel, at an elevation of about 350 feet above sea-level. On a slope a little above the village is a 'hydropathic,' in a more open and bracing situation. In the valley on the other side of the Pass of Killiecrankie is **BLAIR-ATHOLL** (430 feet), with satisfactory accommodation. Visitors can likewise stay at **TUMMEL BRIDGE**, between Loch Tummel and Loch Rannoch, 14 miles from Pitlochrie; and **KINLOCH-RANNOCH**, 7 miles further west, at the eastern end of Loch Rannoch. Near **KIRKMICHAEL** (700 feet), in a moorland district, about 12 miles from Pitlochrie, is a small private sanatorium for the treatment of pulmonary tuberculosis. **BRAEMAR**, or more correctly **CASTLETON OF BRAEMAR** (Aberdeenshire), lies on the Dee, at an elevation of 1,100 feet above sea-level, in a broad valley surrounded by mountains. It is one of the most bracing inland summer resorts of Great Britain. Mean temperature for the year, 43·2° F.; for January, 34° F.; for July, 54·9° F. Mean annual rainfall, 35·96 inches. The meteorological records show 1,187 hours of bright sunshine on the average (a later average gives 1201·7 hours) in the year. The winter months are especially poor in sunshine. May is probably the sunniest month. **BALLATER**, to the east of Braemar, 17½ miles lower down the Dee, is a summer resort of lesser elevation (750 feet). It is the present terminus of the Deeside railway from Aberdeen. **Balmoral Castle** lies between Ballater and Braemar. The **Banchory Sanatorium**, or 'Nordrach-on-Dee,' a sanatorium for the open-air treatment of tuberculosis, is situated amidst pines on the gravel soil of the Middle **DEESIDE**, near the railway station of Banchory. On the Deeside, nearer to Aberdeen, is the 'Deeside Hydropathic' already mentioned. **KINGUSSIE** (745 feet) (Inverness), **AVIEMORE** (700 feet), and **GRANTOWN-ON-SPEY** (740 feet) (Elgin), all in the Spey Valley ('Strathspey'), and **CARRBRIDGE** (915 feet), in a side valley of the Spey, are bracing

summer resorts with stations on the Highland Railway and hotel accommodation. TOMINTOUL, about 15 miles to the south-east of Grantown, likewise has hotel accommodation. On a slope above Kingussie, facing the Grampian range and to the south of the Monadhliadh Hills, in a sheltered position amidst fir woods and moorland, 850 feet above sea-level, is the 'Grampian Sanatorium' for the open-air treatment of consumptive patients ($\frac{3}{4}$ mile from Kingussie railway station). CRAIGELLACHIE, lower down in Strathspey, has comfortable hotel accommodation. We may here also mention FORRES, further north, close to the coast of Elgin, famous from an antiquarian point of view on account of 'Sweno's Stone.' Like Nairn (10 miles to the west, on the coast of the Moray Firth), Forres has a relatively small rainfall, about 24 inches in the year. About a mile to the south-east of the town is the 'Cluny Hill Hydropathic,' in grounds of its own, adjoining the thickly wooded hill crowned by the Nelson Tower.

INLAND RESORTS OF IRELAND

LISDOONVARNA, in County Clare, about 3 miles from the coast, stands at an elevation of about 430 feet above sea-level, amidst undulating heathy moorland destitute of trees. Its climate is bracing, being influenced by the Atlantic breezes and by the open situation of the place. It is best known for its cold sulphur and weak non-gaseous chalybeate waters, and, though a small place, is probably the most popular spa in Ireland. Doubtless the climate contributes much to the bracing and health-giving qualities of the spa. Season, June to October.

LUCAN (about 100 feet), in County Kildare, is pleasantly situated by the River Liffey, 8 miles to the west of Dublin, with which it is connected by electric train. It possesses cold sulphuretted hydrogen waters and satisfactory hotel accommodation with facilities for hydrotherapy. LEIXLIP SPA, 2 miles west of Lucan, has a weakly mineralised spring (64° F.), once very popular with the people of Dublin.

MALLOW, in County Cork, is situated in beautiful country on the Blackwater, and has a mild climate. Its simple subthermal waters (70°–72° F.) were formerly in great repute.

CASTLECONNELL, in County Limerick, lies on the banks of the Shannon, near some rapids. The mineral waters, probably weak chalybeate, were once in great repute. BALLYNAHINCH,¹ in

¹ This place must not be confused with Ballynahinch in the Connemara district of County Galway, a district of mountains, moorland, and lakes, with the coast-line indented by numberless bays.

County Down, 17 miles from Belfast, possesses sulphur waters with a certain local reputation. The cold sulphur springs of SWANLINBAR, in County Cavan, were formerly fashionable.

In our survey of the coast resorts we have already referred to several places not far from the coast, including DUNDRUM, near Dublin, ENNISKERRY and WOODENBRIDGE, in County Wicklow, BLARNEY, near Cork, and the famous Lake District of Killarney.

APPENDIX TO CHAPTER X

By the great kindness of the Director of the London Meteorological Office we are permitted to give the following table, showing recently worked-out meteorological means (up to the year 1905) for various resorts in the British Islands. In this table (unless otherwise stated in the footnotes) the temperature and rainfall averages are for the 35 years ending 1905, and the bright sunshine averages are for the 25 years ending 1905.

Localities of observation	Mean temperature (Fahrenheit)											Annual inches	Mean no. of inches in position			
	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March					
Strathpeffer Spa	36.7	37.2	39.1	43.6	48.2	54.1	56.6	55.0	51.8	45.2	40.4	32.24	1,188.8	27		
Braemar	34.2	34.5	36.3	40.7	46.1	52.7	55.1	53.8	49.8	43.1	38.2	36.00	—	—		
Nairn	37.4	37.7	39.8	44.1	49.0	54.7	57.4	56.7	52.9	46.0	41.0	24.67	—	—		
Aberdeen	37.7	38.1	40.1	43.8	48.3	53.9	57.2	56.5	53.0	46.9	41.9	30.74	1,400.6	—		
Scarborough	38.5	39.2	41.3	44.7	49.3	55.6	59.1	58.7	55.2	48.6	43.6	27.27	1,406.8	—		
Harrogate	36.9	37.7	40.0	44.2	48.9	55.5	58.8	58.0	54.1	46.9	41.7	29.45	1,501.8	—		
Blackpool	38.4	39.3	41.3	45.8	50.7	56.8	59.9	58.5	54.9	49.0	43.6	38.77	1,409.1	—		
Llandudno	41.3	41.8	43.2	47.1	51.6	57.6	60.5	57.0	50.6	45.8	—	30.83	1,455.6	—		
Bettws-y-Coed	40.5	40.5	42.2	46.5	50.8	56.6	60.7	57.5	47.5	42.1	—	42.28	1,271.1	—		
Langsamarch Wells ²	38.3	38.5	40.7	45.1	49.3	56.2	59.5	57.8	53.8	47.4	41.7	46.33	—	—		
Clifton	39.6	40.5	42.4	47.4	53.4	59.4	62.6	61.6	57.7	49.7	44.5	49.9	34.60	—		
Bath ³	40.7	40.3	42.9	47.1	52.1	58.2	63.3	60.9	56.9	50.1	—	40.7	49.8	30.47	1,467.3	33
Falmouth	43.5	43.7	44.4	47.9	52.1	57.6	60.6	60.5	57.4	51.9	—	44.7	51.0	45.43	1,766.1	40
Great Yarmouth	37.6	38.3	40.5	44.8	50.0	56.6	60.7	60.5	56.9	49.6	—	38.6	48.1	25.32	—	—
Tunbridge Wells	37.4	38.9	41.6	46.4	51.4	58.1	61.4	60.7	56.7	48.8	—	38.4	29.68	1,568.4	36	
Margate	39.0	40.0	42.4	46.9	52.4	58.1	62.4	62.3	58.6	51.1	45.2	40.3	23.21	1,639.7	35	
Hastings	39.5	40.1	42.4	47.0	51.9	57.8	61.4	61.6	58.2	51.1	45.3	40.8	49.8	29.07	1,732.9	40
Eastbourne	40.2	41.0	43.0	47.6	52.6	58.4	61.9	62.2	58.8	50.4	—	40.6	50.1	30.89	1,738.7	39
Brighton	39.8	40.6	42.7	47.6	53.0	59.1	62.5	62.2	58.6	51.6	45.8	41.2	50.4	27.68	1,731.2	39
Worthing	38.9	40.0	42.2	47.1	52.3	58.2	61.5	61.5	58.0	50.4	44.7	40.2	49.6	26.96	1,845.4	42
Venmore	41.7	42.2	44.1	48.2	53.1	58.6	62.0	62.4	59.4	52.9	47.4	48.2	51.3	29.69	1,722.8	39
Killarney	43.1	43.3	44.7	47.6	52.1	56.9	59.5	59.5	56.1	50.3	45.7	43.4	50.2	55.49	—	—
Waterford	41.0	42.0	43.1	46.6	51.5	57.2	60.1	59.1	55.5	49.2	41.8	41.6	49.3	40.35	—	—
Valentia	44.6	44.8	45.4	48.5	52.2	56.9	59.0	56.6	51.3	47.6	45.4	50.9	56.45	1,456.8	—	—
Scilly Islands	45.8	45.6	46.1	48.8	52.5	57.8	60.8	61.2	58.6	53.6	49.8	47.2	52.3	33.63	1,811.0	41
Jersey	42.5	43.1	45.1	49.3	53.7	59.0	62.7	63.2	60.4	53.9	48.4	44.2	52.1	34.21	1,926.8	44
Guernsey	—	—	—	48.7	52.8	57.7	61.4	61.9	59.5	53.7	48.7	44.8	51.8	37.65	1,908.8	43

¹ Two years only, 1904-1905.

² Two years, 1904-1905.

³ Seven years, 1898-9 and 1901-05.

⁴ Ten years only, 1898-1905.

⁵ Ten years, 1896-1905.

⁶ Two years, 1904-1905.

⁷ Seven years only, 1899-1905.

⁸ Twenty-five years, 1881-1905.

⁹ Six years, 1900-1905.

CHAPTER XI

THE CAPITALS AND GREAT TOWNS OF EUROPE—VISITS TO
INTERESTING SMALLER TOWNS

THE CAPITALS AND GREAT TOWNS OF EUROPE

THERE are, as we shall point out in greater detail in Part III of this book, a great number of persons suffering from the effects of mental overwork, or of worry, or of social fatigue, or a too sedentary mode of life, &c., for whom nothing more is needed than a holiday with change of surroundings, mental recreation, and more time in the open air. In many such cases part of the holiday may be spent with advantage in some large town, where objects of historic interest, picture galleries, and social distractions, according to individual tastes, exercise a more or less beneficial effect on the mind, and thus indirectly on the body, provided that sight-seeing be moderated so as to avoid fatigue, and care be taken not to get chilled by entering cold churches and museums when heated from walking in the sun. Plenty of time should be spent in the open air; and during warm weather the visits to museums and picture galleries should be interspersed with judiciously arranged excursions into the surrounding country. The choice of the towns to be visited must depend on the season of the year, individual interests &c. The more northern towns are to be preferred during the warmer months, especially during spring and autumn, and the more southern and warmer towns during the colder months of the year. Places in foreign countries are often more suitable as affording greater change than those in the patient's own land. When these journeys are combined with visits to special health resorts, proximity to the health resort in question will often determine the choice of the large towns to be visited.

Many aged persons and others of weak constitution are benefited if part of the colder months can be spent in a warmer and brighter climate, where there is plenty to occupy the mind, and where more time can be spent in the open air than is possible in colder climates. Thus, the large towns in the south of Europe,

such as Rome, Naples, Athens, and Constantinople, may often be visited during winter.

Enough has, we think, been said to show that some of the large towns of Europe deserve mention in the present work, though we cannot, of course, enter on any discussion as to their relative historic, artistic, or social attractions.

London (latitude of St. Paul's Cathedral, $51^{\circ} 30'$ north). The excellent health statistics of London, the largest city in the world, give it a special claim to be noticed in this connection. It has the lowest death-rate of all the great capitals of the world, in spite of its well-known black fogs, and in spite of many of its poorer districts being greatly overcrowded.¹ Naturally, the sanitary conditions of the various quarters differ somewhat from each other, those of the less crowded and wealthier portions, where visitors mostly reside, being the best. London has been much beautified, and many of its thoroughfares have been broadened and improved by the alterations which have been continuously in progress for many years. During this period also the hotel accommodation has been greatly increased both in quantity and quality. The public parks in the midst of London rival those of all other cities. The borders of some of the parks are fairly sheltered from particular winds by lofty buildings adjoining them. This circumstance may be taken advantage of in selecting suitable promenades for invalids and delicate children. Thus, when the east wind blows, the 'Queen's Walk' may be chosen, which leads along the east of Green Park from Piccadilly to the 'Mall.' When the wind comes from the north or north-west, shelter may be obtained in (1) the 'Mall;' (2) the path in Green Park, running parallel to Piccadilly, between the Hôtel Ritz and Hyde Park Corner; and to some extent also (3) the walk along the northern edge of Hyde Park and Kensington Gardens from the Marble Arch towards Bayswater. Similarly, if protection were needed against southerly winds, 'Birdcage Walk,' to the south of St. James's Park, might be selected. In fact, as has been admirably pointed out by Dr. W. Ewart, the climate of London (as also to a lesser degree the climate of smaller towns) is an artificial one. If the wind blows in one street one has often only to 'turn round the corner' into another street to obtain

¹ The connection between the prevalence of pulmonary tuberculosis, on the one hand, and overcrowding and insufficient food, on the other, is well illustrated in regard to the various districts of London by Sir Hugh Beevor's oration on the 'Declension of Phthisis' (Hunterian Soc. 1899); in regard to Paris, by Dr. E. P. Léon-Petit (*Le Phthisique et son Traitement Hygiénique*, Paris, 1895); and in regard to Manchester, by Dr. A. Ransome (*Researches on Tuberculosis*, 1898, p. 11). See also Sir H. Weber on *Tuberculosis*, London, vol. i. p. 52.

shelter, and even the streets are sometimes to some extent warmed by the artificial warmth in the houses on either side. Moreover, though the greater part of London is built on clay, the real surface of the town (with the exception of its parks, gardens, and 'squares'), and even of a great part of its suburbs, is an artificial one, practically impervious to water (owing to its houses and paved and macadamised streets and roads), and so efficiently drained by its gutters that rain water runs off as easily and rapidly as it would from a naturally well-drained surface of granite. All this must tend to diminish the atmospheric humidity of the town and the amount and frequency of fogs. The Meteorological Office gives the following figures for London, based on 15 to 30 years' observations made at Brixton, its official London station: Mean temperature¹ for the year, 49·9° F.; for January, 38·3°; for July, 63·0°. Mean rainfall, 24·84 inches in the year, with 169 rainy days. In regard to bright sunshine the Brixton record shows an annual average of 1,260 hours, that is to say, 29 per cent. of the possible duration, whilst the City of London (Bunhill Row) gets only 23 per cent., and Kew (on the outskirts of the town) gets 31 per cent. These differences are due to the London fogs, and are still more marked during the colder months; thus from November to February Bunhill Row only gets 96 hours, whilst Kew gets 172. W. N. Shaw,² after comparing the sunshine records of London with the average for the southern district of England, says: 'Summing up in few words, we may say that in summer London loses one-sixth of its sunshine, and presumably also about the same fraction of its daylight, on account of its smoke, while in winter its loss amounts to one-half for a similar reason.'

The districts of Kilburn and St. John's Wood have a reputation for dampness, owing to their clayey soil. Kensington, Brompton, Chelsea, Ealing, Battersea, Fulham, and Croydon have milder and more sedative climates than the districts to the north of Hyde Park and between Oxford Street and Regent's Park, and than the Belsize and Finchley districts, Highbury, and parts of the north-east of London. Most of London proper is between 20 and 100 feet above sea-level. Amongst the more elevated suburbs having a fresher climate than Central London we may mention: HAMPSTEAD HEATH (about 430 feet), HIGHGATE (about 410 feet), and MUSWELL HILL, SHOOTERS HILL (about 400 feet), PUTNEY HILL, and WIMBLEDON COMMON (about 180 feet),

¹ The mean temperatures are taken from the simple arithmetical means of the maximum and minimum temperatures recorded each day.

² 'The Treatment of Smoke,' *Journal of the Sanitary Institute*, London, October 1902, vol. xxiii. p. 322.

UPPER SYDENHAM and UPPER NORWOOD, and the neighbourhood of the CRYSTAL PALACE (about 370 feet). Rather further off, we may mention the upper parts of CHISLEHURST (reaching 330 feet) on the south-east, and of HARROW-ON-THE-HILL (reaching 340 feet) on the north-west; also SOUTHGATE, BARNET, TOTTERIDGE, FINCHLEY, and HENDON on the north. The numerous railroads radiating from London put Londoners within easy reach of a number of seaside health resorts, and within 50 miles there are many healthy inland places which have already been referred to.

Edinburgh (latitude 55° 57' north) has historical attractions almost equal to those of London, whilst its smaller size and great picturesqueness render it more pleasing to some persons than London. The town is built on several hills, and the altitude of different portions differs considerably. The fashionable Princes Street is about 200 feet above the sea-level, the castle is about 470 feet, and Arthur's Seat, a hill adjoining the town, reaches to 820 feet, but a good deal of the suburban country (including the Craigleith district) is only 50 to 150 feet. The mean temperature for January is 37·8° F.; for July, 58·3°; for the year, 46·9°. The annual rainfall is slightly greater (25·79 inches), and the annual amount of bright sunshine (1,175½ hours) slightly less than at London (Brixton). The climate is bracing, and is influenced by the proximity of the sea. Portobello, with good sea-bathing, is practically a seaside suburb of the capital. The BRAID HILLS Hotel (about 400 feet above sea-level), close to the golf links of Braid Hills, and the neighbouring CRAIGLOCKHART Hydropathic are suitable for those who wish to visit Edinburgh without living in the town itself. JOPPA on the coast adjoining Portobello has modern hotel accommodation.

From our present point of view the most important characteristic of **Glasgow** (which stands nearly in the same latitude as Edinburgh, though on the opposite side of the strip of country between the Firth of Forth and the Firth of Clyde) is the great facility for beautiful and interesting excursions into the surrounding country, including those to the seaside resorts on the Firth of Clyde, and to the Highland lake districts of Loch Lomond and Loch Katrine. Mean temperature for the year, 46·8° F.; January, 38°; July, 57·7°. Mean annual rainfall, 39·61 inches. The effect of proximity to the Atlantic is obvious. Bright sunshine, 1,096 hours in the year, that is, about 25 per cent. of the possible amount. W. N. Shaw estimates that Glasgow,¹ like London, owing to its smoke and fog, loses one-half

¹ Cf. the table comparing the sunshine at Glasgow with that at Douglas (Isle of Man) given by W. N. Shaw in *Journal of the Sanitary Institute*, loc. cit. p. 323.

of its proper share of sunshine in winter and one-sixth in summer. It may be mentioned that Glasgow, like Edinburgh, London, and some of the large industrial centres of England, possesses facilities for the open-air treatment of consumptives. The 'Bridge of Weir Sanatorium,' together with the late Mr. Quarrier's well-known orphanages, lies 18 miles to the west of Glasgow, about 260 feet above sea-level.

Dublin, the capital of Ireland, owing to its position on the coast, has a more equable climate than London, though the mean annual temperature is only very slightly lower. Latitude, $53^{\circ} 22'$ north. Mean annual temperature, 49.5° F. Mean temperature for January, 41.2° F.; for July, 60.0° F. The amount of bright sunshine in the year (1,514 hours) reaches 34 per cent. of the possible, and is considerably greater than that at London, Edinburgh, or Glasgow. The neighbourhood of Dublin is the driest part of Ireland.¹ Its annual rainfall averages 27.5 inches, whilst that of Cork is about 40 inches, that of Valentia 55.8 inches, some parts of the south-west reaching 70 to 80 inches. There are facilities for sea-bathing. The seaside resorts of Howth, Kingstown, and Bray, and the pleasant inland scenery of Lucan, can be quickly reached by train or electric tram.

The **Scandinavian capitals**, COPENHAGEN, STOCKHOLM, and CHRISTIANIA, are considerably colder than London. Copenhagen, slightly more than 2 degrees of latitude north of Dublin, has a lower mean annual temperature (45.3° F.), with much greater difference between the mean monthly temperatures, so that the mean temperature for July at Copenhagen (61.9° F.) is greater by about 2° F. than that at Dublin (60° F.). Christiania (latitude $59^{\circ} 54'$ north), the most northern of the three capitals, and Stockholm have lower mean annual temperatures (about 42° F.) and colder winters than Copenhagen, but the July climates of all three places are warm, and their mean temperatures for this month (61.9° to 62.6° F.) scarcely differ a degree from each other. Their annual rainfalls range from 16.4 inches (Stockholm) to 22.7 inches (Christiania).

ST. PETERSBURG and **MOSCOW**, as the chief cities of the vast Russian Empire, have much in them besides works of art to attract visitors. **St. Petersburg** is situated on low ground, which was formerly marshy, on the mouth of the Neva, at the head of the Gulf of Finland, at nearly the same latitude ($59^{\circ} 58'$ north) as Christiania. Its climate is very variable. The winters are very cold and the summers warm, and though the mean annual temperature is only 38.7° F., the mean July temperature is as

¹ See Dr. D. E. Flinn's *Irish Health Resorts and Watering Places*, second edition, 1895.

high as 63·9° F. The daily variations of temperature are sometimes very great, as much as 35° F. St. Petersburg is distinguished for an unusually high death rate. **Moscow** lies far inland on several hills with elevations of 500 to 850 feet above sea-level. It has nearly the same latitude (55° 45' north) as Edinburgh and Glasgow, and its climate is cold, dry, and healthy, and very 'continental' in type, with a range of 53° F. between the mean monthly temperatures for January (12·2° F.) and July (65·5° F.). Mean annual temperature, 38·5° F. (nearly the same as that of St. Petersburg). Mean annual rainfall, about 21 inches (chiefly in the summer months).

WARSAW, the chief town of Poland, ranking third in population amongst the cities of Russia, lies on the Vistula, in latitude 52° 13' north, at an elevation of 390 feet above sea-level, and is surrounded by the plain of this part of Europe. Mean temperature for the year, about 45° F.; for January, 24·3°; for July, 65·3°. Mean annual rainfall, 22½ inches. It has some fine parks and gardens, and some handsome thoroughfares, but, considering its large size, possesses little in the way of galleries, museums, and grand buildings to attract visitors.

BRUSSELS, **ANTWERP**, and **AMSTERDAM** are best for visitors in spring and autumn, when the weather is not too hot. The most suitable portion of Brussels for prolonged residence is the modern eastern quarter called the Quartier Léopold, which is the highest part of the town. **THE HAGUE**, the seat of the Court of the Netherlands, may, owing to its beautiful parks, and its close connection with the seaside summer resort of Scheveningen, almost itself be regarded as a health resort.

We will say a few words only on the climates of the following group of **great cities of the German and Austrian Empires**, including (from north to south) Hamburg (latitude 53° 33' north), Berlin, Hanover, Leipzig, Breslau, Dresden, Frankfurt on the Main, Prague, Nürnberg, Karlsruhe (Carlsruhe), Stuttgart, Strassburg, Vienna, Munich, Buda-Pest (latitude 47° 29' north). All of them have continental climates, with hot summers and cold winters, and a good deal of wind, the disagreeable easterly and north-easterly winds making themselves felt chiefly in spring. The mean annual temperatures vary from about 45° to 50° F.; the mean temperatures for January, from 26·6° to about 34° F.; the mean temperatures for July, from about 62·8° to about 71° F. **MUNICH**, the most elevated of these places (1,735 feet), has the lowest mean annual temperature (45·3° F.) and the lowest mean January temperature (26·6° F.). **HAMBURG**, in the north-west, and nearest the sea, has the least difference between the mean monthly temperatures (January, 32° F.; July, 63°); and **BUDA-**

PEST, the most southerly and easterly, has the highest mean annual temperature (49·8° F.), with the highest July temperature and the greatest range between the mean monthly temperatures (January, 28·2° F.; July, 70·3°). The mean annual rainfalls probably vary between 18 and 30 inches. None of these towns are well sheltered from winds. Stuttgart, which lies in a pleasant valley, the slopes of which are covered with woods and vines, is probably the most sheltered. Nearly all of them have great attractions in the way of picture galleries, museums, interesting buildings, opera-houses, &c., and some of them, such as Stuttgart, Karlsruhe, Frankfurt, Dresden, and Vienna, are well known for the beauty of the hilly country within easy reach, or, as Karlsruhe, for the adjoining forests with level walks and drives.

In Switzerland, some of the larger towns, such as GENEVA, BASEL, LUCERN, ZÜRICH, and BERN, have been already alluded to. As places of residence for families, Swiss cities mostly afford the advantage of excellent facilities for the education of children.

Paris (latitude 48° 50' north), with its museums, galleries, parks, luxurious hotels, fashionable shops, and apparent life of gaiety, has irresistible attractions for many persons as a resort affording change of surroundings, and mental recreation. Some spend a portion of almost every holiday at Paris, whether their main object be to rest from work and restore their health or merely to enjoy themselves. The mean annual temperature (51·4° F.) is the same as that of New York, and very slightly higher than that of London, but the range of the monthly means (about 30° F.) is greater than that of London (about 24° F.) and less than that of New York (about 43° F.). Mean temperature for January, 36° F.; July, 65°; April, 49·8°; October, 50·2°. The mean annual rainfall is about 19·7 inches, with 140 rainy days. Paris is on the whole a healthy city, though the mortality in the poorer quarters from phthisis &c. is rather high. Many of the suburbs are very pleasant and full of pretty villas. The Bois de Boulogne is one of the finest public parks in Europe, and within easy reach is Versailles with its historic grounds. At MEUDON, on a slope to the south of the Seine, is the 'Pavillon-de-Bellevue,' with a magnificent view of Paris. It is suitable for a stay in summer and is close to Sèvres, the pleasant village of Ville d'Avray, the park of St. Cloud, and the wood of Meudon. Amongst places rather further from Paris, ST. GERMAIN-EN-LAYE (13 miles), with its famous castle and Gallo-Roman museum, and FONTAINEBLEAU (37 miles), formerly the favourite residence of the French kings, have the advantage of the pure air and shady walks of their magnificent forests, and may sometimes be recommended for a stay during late spring,

summer, and autumn. The spring at these places makes itself earlier felt than in London.

LYONS (latitude $45^{\circ} 45'$ north), the second city of France, in spite of its manufacturing character, has a very handsome and imposing aspect, and can claim the advantage of being within easy reach of many beautiful spots in the French Alps and the French Jura. It lies 218 miles by railway to the SSE. of Paris, and at a decidedly higher elevation above sea-level (about 980 feet to the 100 feet of the Seine region at Paris). The mean annual temperature is 51.1° F., and the range between the mean monthly temperatures is 33.5° F.

In the Iberian Peninsula, LISBON, OPORTO, CADIZ, and BARCELONA have already been mentioned.

Madrid, the capital of Spain, is situated in latitude $40^{\circ} 24'$ north, and at an elevation of 2,140 feet above sea-level, on a small plateau in the middle of a dry, sandy, treeless plain, almost in the centre of Spain. It has a dry, 'inland,' extremely variable climate, exceedingly hot in summer and very cold in winter. Mean annual temperature, about 56° F. The range between the mean monthly temperatures is 36.4° F. (January, 40.1° F.; July, 76.5°). The absolute annual range of temperature is about 95° F., and a sudden variation of 40° or 50° F. may occur at any time of the year. Annual rainfall, about $15\frac{1}{2}$ inches in about 94 days, chiefly in autumn and spring. The sky is clear during two-thirds of the year. Spring and autumn are the best times for a visit to this very modern-looking city with its famous picture gallery and its interesting museums.

Seville (latitude $37^{\circ} 24'$ north), the capital of Andalusia and of the Province of Seville, and for travellers the most interesting and typical of the large towns of Southern Spain, is situated on the bank of the River Guadalquivir, in the middle of a large fertile plain, very little above sea-level. Its warm and sunny winter climate, its picturesqueness, and its art treasures, make it a suitable winter resort for many persons of weak constitution suffering from slight chronic rheumatoid arthritis &c. In summer the heat is rather great. Visitors during the winter months should choose rooms with a sunny aspect, and not on the chilly, sunless ground floors. Mean annual temperature, 68° F. Mean January temperature, about 52.2° F. Mean annual rainfall, about 29 inches, in 34 days.

GRANADA, in spite of its great historical and archæological interest and the picturesqueness of the scenery, is, owing to deficiency of hygienic arrangements, not to be selected for a prolonged stay, unless perhaps in one of the hotels close to the Alhambra.

Rome.—Of all great towns of the world, the capital of Italy is probably the one most frequently used as a winter climatic resort, and is quite unrivalled for its artistic and antiquarian attractions. It lies in latitude $41^{\circ} 53'$ north, on both sides of the Tiber, in the undulating plain of the Campagna, at an elevation of 50 to 170 feet above sea-level. It is about 15 miles both from the Mediterranean coast on the west, and from the nearest elevations of the Apennines (i.e. of the Sabine Mountains)¹ on the east. According to the meteorological data for the years 1876–1894 kindly obtained for us by Dr. Vittorio Balbi, following are the mean monthly temperatures, beginning with January: 43.5° F., 46.5° , 50.7° , 56.7° , 63.4° , 70.8° , 76.4° , 76.1° , 70.1° , 61.2° , 52.6° , 45.6° . Mean annual temperature, 59.6° . Mean temperature for winter, 45.2° ; for spring, 56.9° ; for summer, 74.4° ; for autumn, 61.3° . The mean relative humidity for the year is 64 per cent.; for the three winter months it is of course higher, stated to be 72 per cent. (other information). The mean annual rainfall (1876–1894) is 32.25 inches, occurring chiefly from October to January. The number of rainy days in the year is stated to be about 96. The prevalent wind is the ‘tramontana’ (from the north), which is bracing, but sometimes very cold. The warm moist ‘sirocco’ (south-east wind) is rare, but depressing when it occurs. Some parts of the Pincio region are sheltered from the tramontana. For the last two or three years the water supply has been nearly perfect everywhere, and the hygienic condition of Rome has much improved.²

Dr. Karl Weber, who has long practised during winter at Rome, kindly tells us that in the city of Rome itself malaria is practically never contracted, either during winter or summer. On all sides, however, immediately outside Rome there is malaria. Some years ago he had to treat a family attacked with malaria outside the Porta Pia, where new buildings are being erected. More dangerous parts are the ‘Tre Fontane,’ about 3 miles from the Porta San Paolo, and the ‘Valle dell’ Inferno,’ to the north of the Vatican portion of the city. Still more so are Ostia, 15 miles, and Fiumicino, 20 miles distant.

The best localities for winter residence, says Dr. K. Weber, are the less densely populated parts within the walls in the northern part of the city, where the houses are less crowded together, and cleaner, and where the following hotels are situated: the Grand, Royal, Bristol, Quirinal, Eden &c.; rather

¹ Hadrian’s Villa, near Tivoli (the ancient Tibur), at the foot of the Sabine Mountains, is about 15 miles in a straight line to the east of Rome.

² See Doctor Mendini’s *Hygienic Guide to Rome*, translated by Dr. J. J. Eyre, London, 1897.

lower than these, but still at a certain elevation above the river-level, are likewise some good hotels, as the Hôtel Londres in the Piazza di Spagna, the neighbouring Hôtel Europa, and the Hôtel Russie, close to the Piazza del Popolo. Spring is the pleasantest time (March, April, and the first part of May) for a stay in Rome.

Florence (FIRENZE) is situated in latitude $43^{\circ} 46'$ north, in the broad Valley of the Arno, on both banks of the river, at an elevation of about 180 feet above sea-level. Mean temperature for the three winter months is given as 43° F.; for spring, 56.8° ; for summer, 74.8° ; for autumn, 59.4° . Mean annual relative humidity is 63 per cent. Mean annual rainfall (1876–1895) is 30.6 inches. Number of rainy days in the year, about 114. In the city itself there is seldom any snow. On the north, east, and south are lesser heights of the Apennines, but the protection from winds is very imperfect, notably towards the north, from which bitterly cold winds blow in winter and early spring. In the middle of summer the heat may be oppressive. The pleasantest months of the year are April and May and September to November. The beautiful surroundings increase the attractions which art treasures and historical associations have given to Florence. The ancient town of Fiesole, perched on a height to the north, can be reached in a few minutes by electric tramway. Agreeable walks and drives can be taken in various directions. There are many permanent English residents at Florence, probably more than at any other town in Italy.

Venice and **Naples** have already been described amongst sea-side resorts.

Milan is situated in latitude $45^{\circ} 26'$ north, in the middle of the fertile plain of Lombardy, at an elevation of about 480 feet above sea-level. In summer it is rather hot, and in winter often too cold for delicate persons. There is no good shelter from winds in any direction. Mean temperature for the year, about 55.0° F.; for the three winter months, 35.7° ; for the three summer months, 73.4° ; for January, 32.7° ; for July, 75.3° . Mean annual rainfall, about 40 inches. There are a good many permanent German-speaking residents. The hygienic arrangements are good. Its position in regard to the St. Gothard railway and its proximity to the beautiful climatic resorts of the North Italian lakes cause many invalids as well as ordinary tourists to visit Milan.

Turin, for some years capital of the Kingdom of Italy, forming as it does the Italian end of the Mont-Cenis route, must necessarily be much visited by travellers, independently of its business importance and of the attractions of its university and its collections of armour, pictures, and antiquities. The city lies in latitude $45^{\circ} 4'$ north, in the centre of Piedmont, in the fertile plain

of the Po, with some hilly country close to it on the east. Altitude, about 900 feet. Turin has a 'continental' type of climate, almost as decided a one as Milan has. The difference between the mean temperatures for January (31·9° F.) and July (73·7° F.) at Turin is 41·8° F.; at Milan it is only very slightly greater (42·6° F.).

BOLOGNA, the chief town of *Æmilia*, from its position on one of the chief routes between Northern and Central Italy, is likewise necessarily much visited by travellers. Owing to its situation (altitude, about 280 feet) to the north of the Apennines at the southern edge of a vast plain, it is exposed to cold winds. In summer the heat may be trying. Mean temperature for January, 34° F.; for July, 76·8°.

GENOA (latitude 44° 24' north), in the centre of the Gulf of Genoa, the chief commercial seaport of Italy, may be regarded as separating the Western from the Eastern Riviera. The city has a semicircular arrangement on the ridges of hills above the harbour. It is much exposed to cold winds and sudden changes of weather, and is a rainy place, though it is naturally warmer during winter than Turin and Milan. Most streets of the older portions of the city are narrow, insanitary, steep, and dark, the walls of the houses or palaces on either side being often so high and close together that scarcely a glimpse of the sky can be obtained from the pavement. Nevertheless, the picturesqueness of the site, the grand palaces of the old patrician families, and the great historic interest of the place make Genoa really deserve its title of 'La Superba.' The better, newer quarters are not too cramped. According to Reimer, the end of spring and the commencement of summer are the best times for a visit. The health resorts of Nervi and Pegli are practically suburbs of Genoa, from which they can be quickly reached by steam tramway.

In regard to the climates of some of the health resorts and large towns of Italy, I have made up the following table from figures kindly obtained for me by Dr. Vittorio Balbi, of the University Observatory of Turin.

Place of observation	Years of observation	Mean annual temperature	Mean January temperature	Mean July temperature	Mean annual relative humidity	Mean annual rainfall
		Fahr.	Fahr.	Fahr.	per cent.	inches.
Turin . .	1876-1895	53·6°	31·9°	73·7°	70	34·5
Milan . .	1876-1895	54·7°	32·7°	75·3°	70	40·3
Bologna . .	1879-1895	55·8°	34·0°	76·8°	65	30·5
Florence . .	1876-1895	57·4°	39·6°	75·5°	63	30·6
San Remo . .	1880-1890	60·4°	47·8°	74·8°	69	28·4
Alassio . .	1885-1895	60·8°	46·4°	75·7°	60	32·5
Genoa . .	1879-1890	59·2°	44·8°	74·7°	62	50·25
Venice . .	1876-1895	56·1°	36·3°	75·7°	74	29·4
Rome . .	1876-1894	59·6°	43·5°	76·4°	64	32·25
Naples . .	1876-1895	61·4°	47·3°	76·3°	65	33·75
Palermo . .	1876-1895	63·5°	50·8°	76·8°	65	25·1

Athens (latitude $37^{\circ} 58'$ north) is situated on the north side of the Gulf of Ægina, at an altitude of about 340 feet, $4\frac{1}{2}$ miles by railway from its port, the Piræus. The 'Attic plain' on which the town lies is partially sheltered by the Hymettus, Pentelikon, and other mountains, but is open towards the south. Mean temperature for the year, 63.1° F.; for winter, 49.1° ; for January, 46.8° ; for July, 80.6° . Mean relative humidity for the year, 62 per cent.; for the winter, 63 per cent. Annual rainfall, about 15 inches, distributed over 73 rainy days, chiefly at the end of autumn and commencement of winter. The summers are nearly rainless. In summer the heat and dust are very trying. The winter climate is dry and bracing, with cool mornings and evenings and hot midday sunshine, but the streets are dusty. Athens may be used as a winter resort in many gouty and rheumatic cases, but not in pulmonary complaints or in nervous excitable constitutions. The accommodation in the best hotels is good and the sanitary arrangements satisfactory.

The mean annual temperature of Athens is about the same as that of Palermo, but the climate of the former, as Reimer points out, is drier and less equable, with a colder winter and hotter summer, than that of the latter. **KEPHISSIA**, 8 miles from Athens, and about 1,000 feet above sea-level, can be reached by railway in about 1 hour. Known from ancient times as a favourite summer resort of the Athenians, it would deserve the title of health resort were its sanitary arrangements quite satisfactory. It is situated in a well-wooded and well-watered district on the western slope of Mount Pentelikon, near the source of the Kephissus.

Constantinople (latitude $41^{\circ} 2'$ north), the capital of Turkey, on the western side of the Bosphorus, has a beautiful situation on gradually rising ground around the harbour of the Golden Horn. The city proper is the portion between the Golden Horn and the Sea of Marmora. Scutari, on the opposite (eastern or Asiatic) side of the Bosphorus, is not more than a mile distant. Mean annual temperature, 57.7° F. Mean temperature for January and February, 41.4° F.; for July, 74.3° ; for August, 74.5° . Annual rainfall, 28.8 inches, distributed over 82 rainy days. The climate is very variable, especially during winter and spring. North winds prevail at all times of the year; when a south wind commences to blow, the thermometer may suddenly rise 18° F. The hygienic arrangements have been much improved.

The following tables give the temperature and rainfall monthly and yearly means for some of the chief towns of Europe and North Africa, according to Hann's '*Lehrbuch der Meteorologie*' (1906):

TEMPERATURE (IN DEGREES FAHRENHEIT)

Months	London (N.W.)	Edinburgh	Paris (S. Maur)	Berlin	Vienna	Rome	Constantinople	Naples	Genoa	Cairo	Algiers
January	38.1	37.8	36.1	30.7	28.9	44.2	41.4	47.1	45.7	54.3	53.8
February	39.7	38.7	38.5	32.5	32.4	46.9	41.4	48.9	48.6	57.6	54.7
March	42.1	40.5	42.6	37.2	39.0	50.7	46.2	51.4	51.6	62.4	57.0
April	48.0	44.8	49.8	45.9	48.9	56.7	53.4	57.4	57.6	69.4	61.3
May	53.8	49.6	55.4	54.9	57.2	64.0	62.4	64.2	63.7	75.9	66.2
June	60.3	55.6	61.7	62.1	63.9	70.9	70.3	70.7	69.8	81.1	72.1
July	63.1	58.3	64.9	64.6	67.3	76.3	74.3	75.7	75.7	83.3	75.9
August	62.1	57.6	63.9	63.3	65.8	75.6	74.5	75.9	75.7	81.9	77.0
September	57.6	54.0	58.5	57.0	59.4	70.0	68.4	71.2	70.9	77.5	74.1
October	49.8	47.1	50.2	48.2	49.6	61.5	62.2	63.0	62.4	73.8	67.5
November	43.0	41.4	42.4	38.5	38.3	52.2	53.2	54.1	53.2	64.6	60.4
December	39.2	38.7	36.9	32.9	30.9	45.7	45.7	48.9	47.5	57.9	54.9
Year	49.8	46.9	50.0	47.3	48.6	59.5	57.7	60.8	60.3	70.0	64.6

RAINFALL

Months	London	Edinburgh	Paris	Berlin	Vienna	Rome	Constantinople	Naples
January	in. 2.01	in. 1.93	in. 1.40	in. 1.54	in. 1.34	in. 2.88	in. 3.42	in. 3.39
February	1.60	1.70	1.30	1.45	1.45	2.32	2.71	2.84
March	1.70	1.54	1.50	1.85	2.00	2.48	2.45	2.96
April	1.65	1.50	1.70	1.38	1.97	2.32	1.65	2.36
May	1.93	1.88	1.77	1.74	2.84	2.16	1.19	1.85
June	2.25	2.16	2.13	2.49	2.80	1.50	1.34	1.34
July	2.40	2.80	2.05	2.72	2.64	0.64	1.06	0.66
August	2.40	2.80	2.13	2.25	2.68	1.10	1.65	1.22
September	2.40	2.40	1.97	1.65	1.65	2.71	2.05	2.75
October	2.71	2.52	2.40	2.00	2.00	4.10	2.51	4.30
November	2.29	2.36	1.78	1.85	1.82	4.45	4.01	4.80
December	2.13	2.20	1.80	1.92	1.89	3.26	4.80	4.25
Year	25.47	25.79	21.93	22.84	25.08	29.92	28.86	32.72

INTERESTING SMALLER TOWNS OF EUROPE

For many persons a judiciously planned and leisurely tour through a series of interesting smaller towns is equally entertaining and less fatiguing than a longer visit to some capital city with its vast museums or picture galleries, or its bustling social attractions. European countries are very rich in medium-sized towns suitable for visits of this kind. At some of them magnificent cathedrals and churches, ancient castles and town walls and fortifications of bygone times, remarkable municipal buildings, or quaint old houses, constitute special attractions; as

examples we need only mention in England and Wales, Durham, York, Lincoln, Ely, Peterborough, Norwich, Chester ('the Nürnberg of England' in regard to its quaint old architecture and historic associations), Shrewsbury, Carnarvon, Worcester, Gloucester, Wells, Exeter, Salisbury, Winchester, Chichester, St. Albans, and Canterbury; Ghent, Bruges, Liège, and Louvain, in Belgium; Rouen, Amiens, Reims, Angers, Nantes, Tours, Blois, Nancy, Avignon, and Arles, in France (from the last two places the remarkable Roman and mediæval remains of that part of France may be conveniently visited); Cologne, Mainz, Treves, Worms, Speyer, Strassburg, Augsburg, Regensburg (Ratisbon), Nürnberg, Rothenburg-on-the-Tauber, Bamberg, Meissen, Münster in Westphalia, Brunswick, Hildesheim (with its mediæval art treasures), Königsberg, and the old Hanse Towns of Bremen, Lübeck, and Danzig, in Germany. Ancient university towns have special charms of their own: Oxford and Cambridge, in England; St. Andrews (likewise a bracing seaside resort), in Scotland; Leyden, in Holland; Montpellier (formerly in world-wide repute as a climatic health resort), in France; and university towns in Germany and Austria; but many of the latter, such as Heidelberg, Bonn, Freiburg-i-B., Innsbruck, &c., have great and varied attractions for most visitors apart from their universities.

A good many towns, though possessing ancient castles, magnificent churches, art galleries, or various objects of architectural historical, or antiquarian interest, are equally or still better known for their picturesqueness, or for the **beautiful scenery** of the neighbourhood, or for the numerous interesting excursions which can be made into the surrounding country. Amongst places of this class are Bristol (with the adjacent Clifton), Warwick (with the adjoining health resort of Leamington), and Southampton, with the New Forest localities in its neighbourhood, in England. Luxembourg, the capital of the Grand Duchy of that name, deserves to be mentioned in this group. In France there are Dinan, in a pleasant district of Normandy; Tours and other places, with their romantic associations, amidst the beautiful scenery of the Loire; St. Germain-en-Laye and Fontainebleau with their beautiful forests; Clermont-Ferrand, at the foot of the Auvergne Mountains; Besançon, in the outskirts of the Jura; and Grenoble* with its charming sub-alpine surroundings. In Germany we may especially mention Heidelberg, Bonn, Aschaffenburg, Karlsruhe, Freiburg-im-Breisgau, Constance, Cassel, Eisenach, Gotha, and Weimar. In the Austrian Empire, Innsbruck, Salzburg, and Gratz, situated in the mountainous districts included under the heading 'Eastern Alps,' deserve special notice as combining historical or artistic interest with great beauty of

scenery, good hygienic arrangements, and excellent accommodation. Amongst places in healthy neighbourhoods with fine scenery, but attracting visitors chiefly on other accounts, we must place Bayreuth (with Wagner's opera-house), Ober-Ammergau (with its passion plays), in Bavaria; and Lourdes (with its reputation for miraculous cures), in a beautiful Pyrenean valley in the south-west of France.

All the places mentioned in the preceding paragraphs offer visitors comfortable and generally fairly sanitary hotel accommodation. Some of them, such as Bonn, Cassel, and Freiburg-im-Breisgau, are occasionally chosen as **places of permanent residence** by English families on account of their healthy and pleasant situation, good sanitary arrangements, moderate cost of living, and the facilities they afford for the education of children. Some of them even deserve to be classed as health resorts, and have already been mentioned as such in an earlier portion of the book.

A question frequently arising in the case of men who are retiring from active work (officers in the army and the navy, government officials, professional men &c.), especially in regard to men returning from the colonies, is what place is most suited to them for permanent residence. The choice is often limited on financial grounds, and sometimes the special opportunities afforded by some places for the education of children determines the choice. In the neighbourhood of London, amongst the localities previously mentioned, Dulwich, Sydenham Hill, Upper Norwood, the country near Croydon, Wimbledon Common, Chislehurst, Reigate, Redhill, Guildford, Sevenoaks, Ealing, Twickenham, Toddington, Surbiton, Richmond, Hampstead, Highgate, Watford, and Harrow are favourite localities. The relative advantages and disadvantages of these places have already been to some extent considered. Many places in Great Britain, though close to each other, vary much in their climates owing to a difference of one or two hundred feet in elevation. Thus Boars Hill and Shotover Hill have advantages over Oxford, and the Gogmagog Hills over Cambridge, so that families connected with the Universities may with advantage reside at one of these places during the greater part of the year. Similarly many suburbs of London, as Highgate, Finchley, Hampstead, Shooters Hill, Upper Norwood, and Sydenham Hill, can be utilised by Londoners. So, also, the neighbourhood of the Braid Hills, near Edinburgh, might be preferable for some persons to the city itself. Amongst places for residence in England many old Indians choose Canterbury, Cheltenham, Bath, or Leamington. On the Continent the beautiful little towns and villages on the

Rhine between Bonn and Bingen are frequently chosen by German families, and sometimes by the English. Places such as Bonn, Cassel, Marburg, Heidelberg, Freiburg-im-Breisgau, Gratz, Geneva, Lausanne, and Zürich, are often selected in great part owing to their educational facilities. Sometimes, especially in the case of delicate persons of considerable financial means, international summer and winter resorts, such as Wiesbaden and Baden-Baden, are chosen for permanent residence, on account of their climates, the great beauty of their sites and surroundings, the social attractions of such places, and the medical advice to be obtained there.

PART II

BALNEOTHERAPY AND MINERAL WATER HEALTH RESORTS (SPAS)

**INCLUDING CHAPTERS ON HYDROTHERAPY
IN CHRONIC DISEASES, AND ON LOCALITIES FOR AN
AFTER-CURE TO SPA-TREATMENT**

CHAPTER XII

HYDROTHERAPY, OR THE THERAPEUTIC USE OF PLAIN WATER IN CHRONIC DISEASES

As hydrotherapeutic methods play a very important part in the results attained at many spas, and as the effect of many mineral water baths is nearly the same as the effect of the external application of plain water at a given temperature, it has been thought advisable to give a short account of the principles of hydrotherapy. Hydrotherapy may be employed in both chronic and acute affections, but for the purpose of this book it is only necessary to consider its use in chronic diseases.

Definitions and Nomenclature.—On this head we shall quote our own remarks in Allbutt and Rolleston's 'System of Medicine' (1905, vol. i. p. 342). Under the terms 'hydrotherapy' or 'hydrotherapeutics' the therapeutic use of water is considered, especially in its external application to the body (baths, douches, vapour baths, &c.). Practically speaking, the terms 'hydrotherapy,' 'hydrotherapeutics,' 'hydriatrics,'¹ and 'hydriatry' are synonymous, and we shall use them so. Some would define 'hydrotherapy' so as to exclude the internal use of water, others so as to include only the external use of cold water ('the cold-water cure'). Again, some authors consider hydrotherapy as a subdivision of balneotherapy (balneotherapeutics). It is, however, generally found convenient to regard the first part of the words 'balneo-therapeutics' and 'balneo-logy' as derived from 'balnea' in the late use of the word, i.e. in the sense of bathing resorts, or mineral water health resorts, that is to say 'spas.' (In the seventeenth century, when the chalybeate springs of Spa in Belgium already attracted visitors from all parts of the world, the word 'spa' began to be used by the English to signify any medicinal spring—especially any spring rightly or wrongly supposed to be chalybeate—or mineral water health resort.) Thus balneotherapy or balneotherapeutics comes to signify everything

¹ A less correct but more frequently employed term is 'hydriatrics.' Similarly in German one speaks of 'die hydriatische Technik' instead of 'die hydriatrische Technik,' which would be more correct from an etymological point of view.

relating to 'spa-treatment.' Thermotherapy, or treatment by heat and cold, is intimately connected both with hydrotherapy and balneotherapy. The therapeutic resources of many spas include natural thermal springs used for hot baths, natural vapour baths, and various kinds of mud, peat, and sand used for hot applications. Under hydrotherapy it is customary to discuss not only hot baths and douches, but also vapour baths, and all kinds of hot air baths (which, strictly speaking, should be classed under thermotherapy), including electric light and 'radiant heat' baths. 'Medicated' baths and artificial mineral water baths are also sometimes described under hydrotherapy, but the internal use of artificial mineral waters belongs to balneotherapy or to ordinary pharmacotherapy. The word 'hydropathy' (cf. 'homœopathy,' 'allopathy'), which is perpetuated in the so-called 'hydropathic' establishments ('hydros'¹) of Great Britain, belongs really to a time when the 'water-cure' was more empirical and more in the hands of unqualified practitioners than at the present day. The word should certainly, as far as possible, be avoided in medical works, since the termination 'pathy' ('arthropathy,' 'myopathy') is at present used in quite another sense. The term 'hydrology' (French 'hydrologie') signifies the doctrine of the nature, laws and uses of water in general, and therefore the term 'medical hydrology' includes both hydrotherapy and balneotherapy in the broadest meaning of these two words.

History.—Though known to the ancient Greeks and Romans, and practised to a variable extent in modern Europe from the sixteenth century, it was Vincent Priessnitz, of Graefenberg, in Silesia, who first made this kind of treatment widely known. Its too indiscriminate and energetic use, however, often led to bad results, and its more serious study by regular physicians became urgently needed. In the latter half of the nineteenth century much labour has been devoted to the scientific study of the subject, with the result that hydrotherapeutic treatment now rests on a firmer scientific basis, as the works of W. Winternitz, Fleury, Hayem, M. Matthes, L. Schweinburg, S. Baruch, J. H.

¹ For the benefit of any foreign reader it may be stated that the 'hydropathic' or 'hydro' of the British Islands was originally a kind of boarding house or sanatorium furnished with facilities for the so-called 'water-cure' or 'hydropathic' treatment. It was generally situated in some beautiful or bracing part of the country, and was under the control of a qualified medical man or irregular practitioner. At present the term often signifies merely a hotel or a boarding house at a health resort or some attractive part of the country, and that special facilities for baths, douches, &c., are provided there. A few hydros are more like the typical 'Wasserheilanstalt' or 'établissement hydrothérapique' of Switzerland and Germany, since they are more frequented by actual invalids and are controlled by a qualified medical director, under whose personal supervision patients place themselves. At some hydros alcoholic drinks are prohibited.

Kellogg, and other writers show, but especially the numerous writings of Winternitz himself and his pupils, A. Strasser, B. Buxbaum, &c. The temporary bad reputation of 'baths,' expressed in a well-known hexameter line ('*Balnea, vina, Venus corrumpunt corpora nostra*'), was perhaps connected with the luxury of late Roman or mediæval times, when the *Thermæ* became pleasure resorts, and baths and douches may have been used to stimulate enervated persons to further dissipation.¹

THE INTERNAL USE OF PLAIN WATER

The amount of liquid taken habitually varies much in different individuals, partly owing to individual tendencies and mere habit, partly owing to mode of life. Abundant water drinking probably in most cases leads to increase in the fluids secreted by the body, and for a time at least to increased excretion of urea and the waste products of tissue metabolism, the tissues and the blood itself being, so to speak, washed out by the treatment. In many cases of old-standing valvular heart disease, especially in imperfectly compensated mitral disease, in obese people with weakly acting hearts, and in patients suffering from atony or more or less actual dilatation of the stomach, it is important to limit the fluid part of the food, especially the fluids taken at meal times, in order to lessen the strain on the circulatory apparatus and on the muscular coats of the stomach. In some cases excessive water drinking, such as is frequently indulged in by those employed in muscular exercise in a hot atmosphere,² gives rise to digestive disturbance, especially when the excess of liquid is taken with the meals, because the gastric juice becomes too diluted to act sufficiently or quickly enough on the food in the stomach and abnormal fermentative changes due to microbic action are thereby facilitated. Nevertheless, increase in the amount of water taken internally may be of service as part of the treatment for gout, tendency to urinary gravel or gall-stones, and in constipation from insufficient intestinal secretion. If the ordinary drinking water of the locality be too hard, or of doubtful purity, exported waters of known purity, such as those of Malvern, Evian, &c.

¹ Compare the 'pleasure resort' use of natural thermal baths in various parts of Europe and at various periods, as so vividly described by Poggio in 1416 in regard to the visitors' life at Baden (Switzerland).

² The harmful effects will be of course more marked when, instead of simple water, weak alcoholic drinks (even the weakest forms of lager beer and the German '*Weissbier*') are employed. It is well known that bakers and others working in very hot atmospheres, when they habitually drink excessive quantities of beer to relieve the thirst connected with the heat and sweating, suffer from a condition of chronic '*hydræmic plethora*' and become especially prone to dropsy and degenerative diseases of the heart and blood-vessels, which lead to death at a relatively early age, if acute parenchymatous nephritis or pneumonia does not anticipate the more chronic mode of death.

may be obtained, or distilled water may be used, which for some patients may, as in Salutaris or Globenaris water, be artificially aerated. It is possible, however, according to the researches of O. Liebreich, &c., that distilled water (we presume only when *frequently taken on an empty stomach*) has an injurious influence on the gastric mucous membrane, analogous to the inhibitory action exerted by distilled water on ciliated epithelium and on muscle-nerve preparations as demonstrated in physiological laboratories. Hans Koeppe¹ finds that water from glacier ice is quite as pure as distilled water, and explains the gastric disorders often noted after drinking glacier water during mountain excursions, as being due rather to the extreme purity of the water than to its low temperature. It has even been suggested that the 'Giftbrunnen' (that is, 'Poison-spring') at Gastein owes its bad reputation and expressive name merely to the fact that its water, as Von Waltenhofen has shown, is extremely pure, or rather, extremely weakly mineralised.² If the low osmotic pressure of distilled and very weakly mineralised waters, that is to say, their 'hypotonicity' as compared to blood, is the only cause of their supposed injurious action on the stomach, this drawback may easily be removed by the addition of a little salt to make them more nearly 'isotonic.'

A considerable part of the results obtained from courses of mineral waters is really due simply to the increase in the amount of water drunk.

A moderate draught of cold water acts as a stimulant to the musculature of the stomach, and probably reflexly through the pneumogastric nerve, the frequency of the heart's action is temporarily diminished;³ in some cases, indeed, an unpleasant shock may be produced by the incautious use of cold water, especially of aerated cold water. A refreshing glass of cold water on rising removes subjective gastric disturbances in many persons, and may aid the action of the bowels. Warm water as taken internally at simple thermal springs is more rapidly and easily

¹ 'Reines Wasser, seine Giftwirkung und sein Vorkommen in der Natur,' *Deut. med. Wochenschrift*, 1898, No. 39, p. 624.

² See also W. Meyerhoffer, *Die chemisch-physikalische Beschaffenheit der Heilquellen*, Hamburg, 1902, p. 20. It is, of course, in regard to drinking the water, not in regard to its external application, that the name of the spring has been supposed to be suitable.

³ Cold-water drinking causes temporary reduction of pulse frequency and temporary slight fall of the body temperature, especially of the 'internal' temperature (as measured in the rectum), with a perceptible reduction even in the temperature of the urine voided. Similar effects are observed after cold-water enemata. Winternitz found a reduction of 1.6° F. in the gastric temperature after an enema. Considerations as to the effects on the circulation, nervous system, and body temperature, which are exerted by the internal use of water in the form of draughts, and lavage of the stomach and large intestine, constitute a department of hydrotherapeutics which may be termed 'internal hydrotherapeutics.'

absorbed, and subtracts less heat from the body than cold water ; warm water is often to be preferred in nervous excitable subjects, for diuretic purposes in weak, gouty, and rheumatic patients, especially when taken at bed-time or when cold water causes gastro-intestinal disturbance.

THE EXTERNAL USE OF PLAIN WATER

Methods of external application.—The modes of application are very various, comprising the ordinary whole bath (German, 'Vollbad') at different temperatures, hip baths ('Sitzbäder'), wave baths, and baths in running water, wrapping in wet sheets, friction with a wet towel, shower baths, affusions, and all kinds of douches. The temperature of the douches can be varied during the application ('Scotch' douche, 'alternating douche'). Douches may be applied under the water of an ordinary or mineral water bath ('submarine,' or rather, 'underwater,' douche); in such cases the temperature of the douche may be hotter or colder than that of the bath, and, since the force of the douche is broken by the water of the bath, this method may be, as Dr. S. Hyde noted, applicable to tender or sensitive parts of the body, for instance, a relatively tender joint or the abdomen. Of this the 'douche Tivoli,' as employed at Plombières (q.v.) for abdominal disorders, is an illustration. In actual practice it has been found that, when good results are possible, they can usually be obtained by the judicious use of a very limited number of appliances. Some of the more complicated appliances, such as the well-known one with a series of open rings for giving circular douches at different levels (the 'needle douche' or 'douche en cercle'), are much less used now than they were when first introduced.

Hydro-electrotherapy.—'Electric baths' combine hydrotherapeutic and electrical methods. It is probable, however, that the imagination of the patient has often a good deal to do with the results obtained. In the ingenious 'hydro-electric douche,' which has been advocated by P. Guyenot and W. S. Hedley, the incident stream of water is made to serve as the anode or the kathode of the electric current, which is applied simultaneously with the douche. In the electric 'four-cell bath' ('Vierzellenbad') introduced in 1902 by C. E. Schnée, of Karlsbad, the electric current is of course obliged to pass through the patient's body in order

- 'The term 'Scotch douche' or 'douche écossaise' appears to have originated on the Continent about 1787, when a physician in Savoy applied the term to the ordinary shower bath, with which he became acquainted when studying under Dr. William Cullen in Edinburgh (see H. Forestier, *Annales d'Hydrologie*, Paris, 1900, vol. v. p. 213). So little, however, is this term employed in Great Britain, that in a leading English medical journal we have seen the German 'Schottische Dusche' translated, not as 'Scotch douche,' but as 'Schott's douche,' i.e. of Dr. Schott of Nauheim!

to travel from the troughs of water bathing the arms to those bathing the legs, and vice versa. P. C. Franze,¹ however, points out that it is a mistake to suppose that in the ordinary electric full-bath the water of the bath is a better conductor of electricity than the patient's body, and that therefore more or less of the electric current passes through the water rather than through the body. He finds that the 'four-cell bath' has a milder action than the electric full-bath. This is an important point in regard to diseases and disorders of the circulatory system, amongst which Franze believes that the functional disorders of the nervous regulating apparatus are those in which hydro-electrical methods yield their most satisfactory results.

Electricity has likewise been therapeutically employed for electrolytic effects in medicated or mineral water baths. Thus, when sodium chloride, sodium salicylate, &c., are dissolved in the water of a bath, the 'ions' of chlorine &c. can be made to pass through the skin at the site of the kathode. Dr. F. W. Smith² says that nascent sulphur is deposited in the Harrogate sulphur water by electricity at the positive pole, and he believes that sulphur deposited in this way on the skin of patients is more active and beneficial in certain skin diseases, such as eczema, psoriasis, lichen, &c., than when the sulphur is employed in the form of the ordinary mineral water sulphur baths.

Hot air and vapour baths.—Allied to hot water baths are the various forms of hot air and vapour baths which, for convenience, are likewise included under the term 'hydrotherapeutics.' These can be given at higher temperatures than hot water baths, and produce a greater amount of sweating. We need not here describe the ordinary Turkish and Roman (hot air) or the Russian (vapour) baths, nor need we stop to consider the methods of administering ordinary hot vapour or hot air baths in boxes, tents or beds. Amongst hot air baths we include the various forms of 'radiant heat' baths for which electric light³ is made use of, such as those introduced by Kellogg in America, W. Winternitz in Austria, W. S. Hedley, Dowsing, &c. in London. In

¹ *Technik, Wirkungen und Indikationen der Hydro-Elektrotherapie bei Anomalien des Kreislaufs*, München, 1905.

² *British Medical Journal*, February 16, 1901; and *Lancet*, August 10, 1901.

³ Concerning electric light and 'radiant heat' baths the reader may consult the article by Dr. J. H. Kellogg (Superintendent of the Battle Creek Sanatorium, in Michigan, practically the initiator of this method of employing electric light) in *Fortschritte der Hydrotherapie, Winternitz Festschrift*, 1897, p. 126. See also 'Künstliches Licht als therapeutischer Faktor,' by Dr. Dermitzel, of Charlottenburg, in *Zeitschr. für diätetische und physikalische Therapie*, Leipzig, 1898, vol. ii. p. 160; and the articles by Dr. W. S. Hedley, Dr. Douglas Kerr, and others in the *Journal of Balneology and Climatology* (London, 1899, vol. iii.), on the therapeutic uses of heat.

these methods the light may possibly exert some action on the skin in addition to its mere heating effect, and at all events light rays penetrate the skin more deeply than heat rays even if they are finally transformed into heat rays. *Local* baths (and sometimes douches) of hot vapour and hot air are likewise made use of at health resorts, especially the Berthollet vapour baths, and the various local hot air and radiant heat baths on the Tallerman, Dowsing, Greville, and other systems (the varieties of apparatus mentioned by J. Marcuse and by G. Hauffe—see Bibliography—are astonishingly numerous). Local douches of hot vapour or hot air may be occasionally employed either alone or in combination with a general hot vapour or hot air bath.

It need hardly be mentioned that the temperature of douche rooms and dressing rooms should be properly regulated. The air in Turkish baths &c. should never be allowed to get foul, and if constant ventilation during use be impossible, as in the case of the small vapour baths at some spas, thorough ventilation at suitable intervals between use is required. Floors, walls, and all the apparatus used should always be kept perfectly clean. Not only should they be clean, but, for the sake of the impression on the patient's mind, they should always look clean. It must be owned that the appearance of 'box' vapour baths, the seats used for rectal douches and other apparatus, is often anything but pleasant; although they may in reality be clean, yet owing to discoloration and want of repair, they often look dirty. In this respect the bright-looking polished 'box' vapour baths on the C. A. Berthe system look especially well when new, but of course in time they become discoloured and untidy-looking like the rest.

Reaction of the body to cold and heat.—The results of treatment by all these means are in great measure due to the natural reaction of the body to cold and heat: water is generally preferred to air for this purpose, because its greater specific heat and greater co-efficient of heat-conductivity render it more active in bringing about the reaction. Human beings are particularly susceptible to hydrotherapeutic effects, because the skin, unlike that of most warm-blooded animals, is unprotected by any natural covering; whilst the clothes, by which the body is usually protected, increase the sensitiveness of the surface to changes of temperature, forming as they do a kind of habitual thermal zone about the body, the temperature of which has been shown by Winternitz to remain fairly constant at about 89.6° F. (30° C.).

Temperatures of baths.—An ordinary bath must therefore have a temperature of some degrees below or above 89.6° F. in order that a decided reaction may be obtained; though owing to mechanical stimulation, a douche, even at tepid or neutral

temperatures, can exercise some reactive effect. Baths between 85° and 95° F. are called tepid (ordinary temperature 90° F.). Any bath below 70° F. is called cold. Hot baths are those of, or over, 96° F. Those from 104° to 114° F. are very hot, and even local applications, such as douches of water at 111° F., seem as hot as can well be borne,¹ though hot vapour baths are taken at 122° F., and the temperature of the caldarium of hot air baths is 130° to 150° F. or even more. In Roman baths, if there are several very hot chambers, the hottest is occasionally kept at 230° F., and electric light baths (when the head is excluded) are given at 200° to 300° F. or higher. These very high temperatures can of course be employed for *local* hot air baths, by the Tallerman and 'radiant heat' appliances.

Hydrotherapeutic reaction for cold.—When a man jumps into a cold bath, the cold produces at first a disagreeable impression. He shivers, and, after an almost involuntary pause in breathing, inspires very deeply. Owing to the contraction of the cutaneous blood-vessels, the skin is pale, and the contraction of the unstriated muscle fibres gives rise to the phenomenon of 'goose skin.' These effects may give place to the main 'reaction' whilst he still remains in the bath, or only when he comes out of it. The pallor of the skin gives place to slight reddening, accompanied by an agreeable subjective sensation of warmth, easy breathing, and a feeling of comfort and capability for exertion.

The rapidity and degree of this 'hydrotherapeutic reaction for cold' varies very much in different individuals. It is delayed in the weak and feeble, but develops early and rapidly in the robust, especially if they have been in the habit of taking cold baths. In strong persons accustomed to cold baths the preliminary vasoconstriction and subjective feeling of coldness are less marked, whereas the reaction (with the pleasant subjective feeling which accompanies it) occurs more readily. The reaction in a given case depends on the temperature of the water, the length of the application, the movement of the water (as in wave baths of all kinds), and, in the case of a douche, on the size (and shape) and force of the stream and the part to which it is applied; it is greatly assisted by voluntary muscular action, and by friction to the skin before, during, or after the application. The reaction may be hindered if the cold is applied for too long a time. The best reaction with the least loss of heat is generally obtained by cold applications of short duration, administered when the patient is hot.

¹ The local mud ('fango') baths of the North Italian spas are usually given at a temperature of 104°–122° F., but it must be remembered that, owing to the imperfect heat conduction in the mud, the temperature of the layer next the skin is soon lowered.

Mechanism of the reaction.—The vascular and respiratory phenomena following on the application of cold water to the surface of the body are generally considered to be mainly, if not entirely, due to nervous reflex action. Many experiments are cited in confirmation of this view, and in the case of men with partial paralysis and anæsthesia, the vascular phenomena have been found diminished or absent in the paralysed limbs. That the respiratory phenomena are not altogether voluntary is shown by similar reflex movements being obtained through stimulation of the skin in animals rendered insensible by chloral (Roehrig).

The initial pallor of the skin is due to contraction of the cutaneous blood-vessels, and may be interpreted as an attempt on the part of the organism to hinder excessive loss of heat, or, at least, to moderate it until increased heat-production in the body can be established to counterbalance the increased loss. When the main reaction sets in, the cutaneous blood-vessels become dilated, giving rise to redness of the skin and a subjective sensation of warmth. This reactive flushing of the skin may be interpreted partly, perhaps, as a provision on the part of the organism to facilitate overflow of surplus heat when increased heat production has once been established, but chiefly as the means of supplying heat (which can only be carried by the blood) to the surface of the body to take the place of the heat which is being rapidly lost owing to the cold application.

The blood is the great carrier and distributor of heat through the body, and it is probable that, corresponding with the cutaneous pallor, the internal blood-vessels become dilated and the central temperature rises slightly; whereas, when the surface vessels during the reaction dilate, the skin is objectively warmer, and, the internal parts of the body being less supplied with blood, the central temperature undergoes a slight fall.

Lately Onimus,¹ whilst admitting that the sudden contraction of the small blood-vessels which follows the application of cold to the skin is due to vaso-motor nervous action, argues that the subsequent vascular dilatation is not a nervous phenomenon (vaso-dilator or neuroparalytic), but is a reaction originating in the vessels themselves. In the same way he regards the vascular dilatation which forms the most obvious part of the 'hydrotherapeutic reaction for heat' (see further on) as a purely autonomous movement of the blood-vessels, independent of vaso-motor nerves. He compares the autonomous movements of blood-vessels to the peristaltic movements of the intestines.

Alois Strasser² draws a sharp distinction between the vascular

¹ *Gazette méd. de Paris*, October 15, 1898.

² *Blätter für klinische Hydrotherapie*, 1899, Nos. 4 and 5.

dilatation due to the local employment of heat and the reactive hyperæmia following the application of cold. The first, he maintains, is of a 'passive' nature, a true congestion with diminished vascular tonicity, tending to lower the blood pressure and increase the frequency of the pulse; whereas the second is an 'active' phenomenon, the vascular tonicity being maintained or heightened, the local circulation increased, and the tendency being for the blood pressure to rise and the pulse rate to fall.

Results of cold water applications.—Liebermeister was the first to prove experimentally that heat production in the body is increased by application of cold to the skin. Increased heat production requires increased combustion in the tissues, and this is evidenced, as it is during muscular exercise, by increase in the amount of carbonic acid gas expired. The increased flow of urine following the bath is certainly not due to the very small quantity of water estimated as absorbed during a bath through the skin, but is doubtless due to increased blood pressure and circulation in the kidneys.

By cold water treatment the heart's action should be strengthened, the respiratory organs exercised, the appetite increased, the digestion of food aided, and the movements of the bowels rendered more active; moreover, undue accumulation of waste products in the tissues will be prevented, owing to the more perfect oxidation within the body and the increased removal by the urinary and other excretions. Secondly, and gradually, the quality of the blood¹ will be improved, and the nutrition of all the tissues of the body furthered. The tonic effect on the nervous and muscular systems produces a desire for physical exertion, and makes work feel lighter. Moreover, the resulting increase in the amount of exercise taken will lead to the processes

¹ By the researches of Winternitz, Thayer, Grawitz, Murri (*Policlinico*, 1894, No. 12), and others, it has been shown that the application of cold baths leads to an immediate but temporary increase in the density and corpuscular richness of the circulating blood. This may be compared to the increase in red corpuscles shown by J. K. Mitchell (*American Journal of Med. Sciences*, 1894) to be an immediate result of general massage. It is not to be confounded with the gradual increase of red corpuscles and hæmoglobin in the blood of anæmic patients, which was found by Dr. Thernes (quoted by Scheuer, *Essai sur l'hydrothérapie dans les états chloro-anémiques*, Paris, 1885, p. 99) and others to result from a judicious course of hydrotherapeutic treatment. A sudden temporary increase in the blood density and the number of both red and white corpuscles may be merely a mechanical result of various therapeutic procedures (baths, massage, and any kind of exercise), and may be explained, after W. Winternitz, J. K. Mitchell, and H. Senator (von Leyden's *Handbuch der Ernährungstherapie*, vol. i. p. 365), by supposing that a large quantity of corpuscles and slightly inspissated blood, which had previously been more or less arrested in various parts of the body, especially in the abdominal viscera, is carried back into the general blood stream owing to a sudden improvement in the circulation (compare A. Strasser, *Blätter für klinische Hydrotherapie*, 1899, Nos. 4 and 5).

of metabolism being more speedily and more perfectly carried out; this will be of great utility for many invalids of a torpid and phlegmatic type, especially those who are rather inclined to be fat.

Hydrotherapeutic reaction for heat.—In hot water¹ treatment the most marked phenomenon is the dilatation² of the superficial blood-vessels, which passes slowly off when the application is discontinued. With the dilatation of the surface vessels are associated increased secretion of sweat, and greater frequency of respiration. This triple effect of the treatment constitutes the reaction of the body to heat, and the three phenomena must be interpreted as the means by which the animal mechanism produces an increased loss of heat to counteract the heating effect of the hot application. The sweating is of course greatest in a hot air bath, though often more visible, as well as more rapidly and comfortably obtained, in a hot vapour bath. Experiments³ show that one of the immediate effects of hot baths is to greatly increase the amount of oxygen taken up and of carbonic acid given off by the body. This does certainly not signify that the average effect of frequent hot bathing is *per se* to increase metabolism (see next paragraph).

Results of hot water applications.—When the application of heat is general and sufficiently prolonged, a decidedly sedative effect follows the preliminary excitation, and is probably due in part to a certain anæmia of the brain and internal organs accompanying the superficial vaso-dilatation, and in part to diminished combustion in the tissues, accompanying diminution in the amount of heat production required to maintain the body temperature. A diminished desire for exercise is part of the general sedative action following hot baths, and a period of rest must generally be allowed to follow hot baths (whether of water, air, or vapour) and hot douches. The occasionally somewhat constipating action on

¹ Hot baths are those of, or over, 96° F.; very hot baths are those of 104° to 114° F.

² The effects of occasional and habitual application of heat to the surface of the body may be contrasted with each other. Though a hot bath of any kind tends to redden the skin by dilating its blood-vessels, residence in a hot climate or the almost constant application of heat (as in the case of stokers, cooks, &c.) tends to produce pallor by diminishing the cutaneous vascularity. In warm climates less heat is lost to the surrounding air than in cold climates; hence heat production is diminished, and a smaller supply of heat (therefore a smaller supply of blood) is required in the skin to maintain the temperature of the surface of the body. On the other hand, in cold climates a greater supply of blood (that is, a greater amount of heat) is required by the skin to counterbalance the loss of heat due to the coldness of the surrounding air. Thus the vascularity of the skin is generally greater in cold climates than in hot ones, and amongst natives of Northern Europe than amongst natives of the Mediterranean coast.

³ See H. Winternitz, *Deut. Arch. f. klin. Med.* 1902, vol. lxxii. pp. 258-290.

the bowels may be due in part to diminished peristalsis, and in part to relative anæmia of the viscera and a diminution of intestinal secretion contrasting with the increased secretion of sweat from the surface of the body.

Reactions to local applications.—When the application of cold or heat is limited to one part of the body instead of being general, certain remote reactions have been observed to take place in addition to the ordinary local ones. Apparently when a limb is immersed in cold water, the corresponding limb of the opposite side reacts with it, becomes like it colder, and, like it, shows diminution in volume as measured by the plethysmograph, the diminution in volume being in this case doubtless the result of reflex vaso-motor action. According to some observers, inverse phenomena take place at another level of the body; thus, during the application of a cold hip bath, Winternitz observed an increase in the volume of the arm. To explain this phenomenon it has been suggested that the flow of blood to the arm may be merely a mechanical result of vaso-constriction in the abdomen (induced by the cold hip bath). Many other instances of the remote effects of local hydrotherapeutic applications have been ascertained, and the changed distribution of blood in all these cases can be explained, either as a vaso-motor reflex effect, or else as the mechanical result of the alteration in the amount of blood in the part directly affected by the local application.

The local application of heat (Berthollet vapour baths, hot air and 'radiant heat' baths) tends to increase the quantity of blood in the part and possibly helps to flush out the tissues and remove accumulated products of catabolism. It doubtless modifies processes of local nutrition, and it has been supposed to favour metabolic processes, because all chemical action is to a certain extent promoted by heat. Both the local application of heat and the local application of cold (e.g. ice bags or rubbing with ice) can sometimes exert an anodyne or soothing influence, though heat may be said to have a relaxing or sedative action, which contrasts with the tonic action of cold, on the vessel-walls of the affected area.

Utility of hydrotherapeutic methods. Hot applications.—Simple hydrotherapeutic treatment is often combined with residence at some health resort, and in such cases, change of air, food, occupation, and mode of life must contribute largely to the result arrived at. Hot water, air, or vapour baths (local or general), and the dry or wet pack, may be useful in 'muscular rheumatism' and lumbago; treatment by diet, massage &c. should often be combined. In chronic rheumatism, gout, and the uric acid diathesis, the milder hydrotherapeutic procedures are usually preferred, com-

bined with the regulation of diet, active and passive exercise, and the diuretic effect of water taken internally. Hot, or alternating ('Scotch') hot and cold, douches, combined or not with massage, are often employed for the stiffness and thickening produced by rheumatoid arthritis, chronic or subacute rheumatism, gout, and old injuries about the joints; also for some chronic cases of sciatica and gouty or rheumatic 'neuralgias.' Local hot vapour (Berthollet) and hot air (including local 'radiant heat') baths are often prescribed in a similar class of cases, especially if there is much pain. They can be given at higher temperatures, and are not so fatiguing as general baths; they are therefore more suitable in weak patients, and persons with dilated hearts. As a general rule, however, when the local affection depends more or less on constitutional causes, unless there be special contra-indications, the application (douche, vapour baths, douche-massage, &c.) should be general, though specially directed in regard to the local complaint.

Cold applications.—Cold water treatment, according to the reactive powers and the constitution and habits of the individual, is useful in cases where it is desired to stimulate metabolism and promote the general nutrition, as in some slighter forms of anæmia and other cachectic conditions, in some cases of atonic and (notably) nervous dyspepsia, and in many functional nervous disorders. It serves to 'harden the skin,' that is, to render persons less susceptible to reflex influences (as from sudden changes of temperature), and thus may be of use in patients with a tendency to 'catch cold' when exposed to the least cold and damp, or to suffer from muscular pains, or repeated attacks of diarrhoea. It may be employed amongst tonic measures for convalescents, or in the 'after-cure' of persons treated by mineral waters for disorders of the digestive system or metabolism. Some patients with habitual constipation, and women with profuse menstruation of constitutional origin, derive benefit from cold water treatment. In all cases, however, the methods to be adopted must be selected with due regard to the general strength and reactive power of the individual patient. Persons of strong constitution whose mode of life has been too sedentary and who have been accustomed to eat too much in proportion to the muscular exercise taken, are often likely to be benefited by a course of cold water treatment. In persons with a tendency to corpulence, though hot vapour and hot air baths are frequently employed, it must not be forgotten that by themselves Turkish baths &c. do not tend to reduce weight beyond the temporary reduction caused by sweating; but cold water methods judiciously employed after the sweating (cold douching, swimming in cool water) may do good by increasing

catabolic processes and thus assisting the dietetic treatment for obesity.

Tepid baths.—Tepid baths are naturally preferred, when a macerating action on the skin is required, or when, for any other reason, a very prolonged application is wanted. For their sedative effect on the nervous system they can often be employed (especially the natural thermal waters) in functional nervous affections, insomnia, and various disorders of metabolism, when occurring in the erethic class of persons.

Estimation of individual reactive powers.—In hydrotherapeutic as in other kinds of treatment the choice of the methods to be employed must depend largely on the reactive powers (temporary or habitual) of the patient. These can to some extent be estimated by simple tests. W. Winternitz¹ finds that by simply washing a part of the body and noting the effect on the skin, information as to the irritability of the vaso-motor system, the power of the heart and the degree of the pathological process may be obtained. Such a simple test needs of course a practised eye and practical experience to make it valuable. To test the hydrotherapeutic reaction in individual cases, J. H. Kellogg refers to the following method as likely to be of use. The surface temperature at each elbow-joint is taken (ordinary minute thermometers may be used if surface thermometers cannot be obtained). Then the right arm is plunged into water at about 50° F. (10° C.), and kept there half a minute. The temperature of the arm is measured again after this and repeatedly with intervals of about fifteen minutes. During this process the colour of the skin must be observed and the development of a cutis anserina. If the natural temperature &c. of the arm be regained in about forty-five minutes, the patient probably possesses a normal power of reaction. However, very weak patients may react tolerably well to local applications of cold, when general applications are badly borne. In such cases the effect of the first bath must be carefully observed, and the future treatment must be regulated accordingly. If the reaction be insufficient, stimulating methods are required. If the reaction be excessive, it may be lessened by using water a few degrees less cold, or by diminishing mechanical stimulation, the patient taking less exercise before and after the bath, clothing himself less warmly after the bath, &c. After short very cold applications, with much friction, a bright red colour of the skin should, according to Kellogg, normally appear in a minute at the latest. When this does not occur, the cold application

¹ See account in *Treatment*, London, September 14, 1899, p. 427, from Hellmer's note in *Blätter für klinische Hydrotherapie*, 1899, No. 7.

should be preceded by a hot one, such as a warm shower bath, an ordinary hot bath, &c., whereby the thermal stimulation is increased. The importance of knowing the peculiarities of the patient's constitution when recommending the kind of treatment to be adopted, is more fully considered at the commencement of Chapter XXXI.

Precautions and contra-indications.—In weak patients, especially those of a nervous excitable temperament, a course of cold water treatment is often made to begin by tepid douches, friction with a wet towel, or some other of the less active hydrotherapeutic procedures, the cold douche itself, or immersion in cold water, being withheld during the early part of the course, but being gradually led up to by the preliminary measures. In patients who feel the loss of heat excessively, especially if preliminary warming by exercise be difficult, a cold douche or cold bath of very short duration may be immediately preceded by a short warming application (hot bath, vapour bath, hot douche), or the douche may be gently alternating, hot and cold, so as to obtain a strong reaction without withdrawing too much heat from the body. Preliminary hot baths and soaping are often likewise of use to render the skin more sensitive, and facilitate the reaction by the removal of greasy matter from the surface of the body.

For the success of cold water treatment it is necessary that the organism can stand some abstraction of heat, that it can react to the stimulus of the cold, and that the digestive and assimilative organs are in fair condition. Especial care is needed in anæmic conditions and in debility resulting from disease, in the weakness of early childhood, in older children about the period of puberty, when they have 'outgrown their strength,' and in old age. Cold water treatment is to be avoided in chronic nephritis, and when it induces the presence of albumen or blood or blood pigment (hæmoglobinuria) in the urine. It is contra-indicated in considerable arterio-sclerosis, in all cases of aneurysm, in tendency to hæmorrhage from the lungs or stomach, and where there has been an attack of cerebral hæmorrhage, or where the occurrence of an attack is feared. It is likewise contra-indicated in most cases of organic heart disease, except slight well-compensated affections of the mitral valve. Very hot baths are to be avoided in tendency to hæmorrhages and cerebral congestion, in most cases of cardiac and vascular disease, and in feeble and erethic individuals. Care must be taken not to overheat the body, and therefore all very hot applications, if general, must be of short duration. Needless to say, no baths of whatever sort should be taken soon after meals, when a specially great amount of blood is required in the abdomen for purposes of digestion. In cases of

disease hydrotherapeutic treatment should only be carried out under the supervision of a medical man.

Localities for hydrotherapeutic treatment.—There exist a large number of establishments where hydrotherapeutic treatment can be obtained. It will be sufficient to enumerate some of them. In England there are those of Malvern, Matlock, Sidmouth, Conishead Priory near Ulverston, Ben Rhydding, Ilkley, Farnborough, Limpley Stoke (near Bath), Bushey (near Watford), Beulah Spa (Upper Norwood), Richmond (Surrey), &c. In Scotland: Dunblane, Crieff, Peebles, Wemyss Bay, Pitlochry, and others. In Ireland there is St. Anne's Hill (Blarney, in County Cork). In Germany and Austria there are those of Nassau, on the Lahn; Godesberg and Bendorf, on the Rhine; Marienberg and Mühlbad, at Boppard, on the Rhine; Laubbach, near Coblenz; Elgersburg, Ilmenau, Liebenstein, and Eisenach, in the Thuringian Forest; Bad Nerothal and Dietenmühle at Wiesbaden; Reinbeck (Sophienbad), near Hamburg; Bad Stuer, on the Plauer See in Mecklenburg-Schwerin; St. Blasien in the Baden Black Forest; Teinach, in the Würtemberg Black Forest; Lauterberg, in the Harz Mountains; Wilhelmshöhe, near Cassel; Schweizermühle and Koenigsbrunn, in the 'Saxon Switzerland'; Koenigstein, in the Taunus; Alexandersbad, near Wunsiedel; Constance; Graefenberg-Freiwaldau, in Austrian Silesia; Kaltenleutgeben, not far from Vienna; Kaltenbrunn, near Voeslau; Kaltenbach, at Ischl in Austria; Alpenheim, at Aussee; Hygiea, at Meran; Marilla, in Hungary, &c. In Switzerland there are the establishments of Champel, near Geneva; Aigle-les-Bains; Rigi-Kaltbad; Schönbunn, Schönfels, and Felsenegg, near Zug; Schöneck, above the Lake of Lucerne; Mammern, in Canton Thurgau; Brestenberg, in Canton Aargau, and other places. In France there are establishments at Paris, Auteuil, Gérardmer, Divonne, Nice, Bordeaux, &c.; and treatment can be had at Monaco. In Belgium we may mention Dinant. There are likewise establishments for hydrotherapeutic treatment at most of the chief Continental spas. Those in England are fewer in number, and usually more of the nature of ordinary hotels than those abroad.¹

Associated factors in the treatment.—When the hydrotherapeutic establishment is situated away from the patient's home, the treatment necessarily brings with it the associated effects of change of air, food, occupation, and mode of life. Hydrotherapeutic courses may likewise be combined with massage, Swedish gymnastics, graduated walking or cycling exercises, with special dietetic 'cures' (cf. Chapter XXX, Sanatorium Treatment);

¹ Compare the footnote on the 'hydropathics' or 'hydros' of Great Britain at the commencement of the chapter.

and with the internal use of mineral waters or ordinary pharmaceutical preparations. At some hydrotherapeutic establishments baths of artificial mineral waters, gaseous baths, brine baths, mud baths &c. can likewise be obtained. Sometimes balsams and various aromatic substances are added to baths ('pine baths,' 'aromatic baths,' &c.) on account of their agreeable or slightly stimulating effect. With these may be mentioned the sea-weed ('ozone,' 'iodine') baths, employed at some seaside resorts. By bathing in rivers, lakes or sea one obtains the additional influence of exposure to open air and sunlight and perhaps the mechanical stimulation of the surface of the body by swiftly running water or by waves. In swimming the factor of muscular exercise is doubtless often at least as important as the mere bathing. Many spas and summer health resorts are provided with good swimming baths (fresh water or brine) or offer facilities for open-air bathing in fresh-water rivers and lakes or the sea. As a form of exercise a certain amount of swimming may often be recommended to convalescents and others, especially in the case of young persons.

CHAPTER XIII

CONSTITUENTS AND CLASSIFICATION OF MINERAL WATERS

Definition of natural mineral waters.—Natural mineral waters form a part of *Materia Medica*, and from very early times have been employed in the treatment of disease, either internally or in the form of baths. Burney Yeo rightly points out that all springs are more or less mineralised, and strictly speaking therefore all of them might be included under the heading 'natural mineral waters.' As a convenient definition, however, from the medical point of view, we choose the following: Natural mineral waters are all waters which, as obtained from nature, are distinguished from ordinary waters either by the salts or gases they contain in solution or by their temperature being elevated, or by some therapeutic virtue being attributed to them. The study of the origin and composition of natural mineral waters belongs to the sciences of chemistry, geology and physical geography.

It may seem a stretch of the term to include amongst mineral waters simple thermal springs seemingly hardly differing from ordinary springs except in their elevated temperature (or recently discovered radio-active properties), but it is certainly convenient, as well as the custom, to do so. It must, moreover, be remembered that before chemical analyses were made, attention had been drawn to many springs on account of the natural warmth of their waters, rather than on account of any special taste or smell due to peculiar chemical constituents. The Roman remains at thermal springs, such as Bath in England, bear abundant evidence to this. In other cases, probably the smell of sulphuretted hydrogen, the taste of Epsom salt (magnesium sulphate), common salt, or iron, or the appearance of ochreous or other deposits, first drew special attention to the springs, though later on, in many instances, some curious tradition, superstitious belief, or ceremony, was connected with the discovery.

Relative suitability for medical purposes.—Not all mineral waters are suitable for use in medicine. Some of the strong iron waters contain too much of the irritant sulphate of iron¹ to be

¹ See the sections on English and Continental sulphate of iron waters in Chapter XXIII, and on sulphate of iron and arsenic waters in Chapter XXIV.

used internally in ordinary cases of anæmia. Some waters contain too much of the sulphate and carbonate of calcium. Sea water, one of the strongest of mineral waters, though of great use for bathing, is seldom taken by the mouth on account of the excess of common salt, and disagreeable taste.

Temperature of the springs.—The temperatures of springs differ widely from each other. Chaudes Aigues, in France, has waters of at least 180° F., and Ax-les-Thermes in the Pyrenees possesses a spring of 171·5° F. Nearer to England there is a spring at Burtscheid, adjoining Aix-la-Chapelle, whose temperature reaches 167° F. Some of the Russian waters are still hotter. According to Dr. F. G. Clemow, the waters of Goriatchevodsk and Bragoun, in the Caucasus, vary from 190° F. to 197° F. (92° C.), whilst the springs of Bananin, in Kamtchatka, of Kalvadjar, in the Caucasus, and the hot spring of Karkin, in Transbaikalia, are all of them said to be at or near boiling point. One of the springs of Hammam Meskoutin, in Algeria, has a temperature of 203° F. (95° C.), and the boiling point is attained by the Great Geyser of Iceland and by geysers in other parts of the world.¹ The other extreme is illustrated by the springs of Yamarof, in Eastern Siberia, whose temperature is only 35·4° F. (1·9° C.), and therefore only slightly above freezing point.

The abundant supply of some of the hot springs is extraordinary, and during winter they can be used for heating dwelling houses (Chaudes Aigues, &c.). For medical purposes the high temperatures are of course useless, and necessitate special

¹ Besides those in Iceland there are geysers in the Rotorua district of New Zealand, in California, and in the Yellowstone National Park of the United States of America, and in Tibet. 'Many theories have been offered,' says J. K. Crook (*Mineral Waters of the United States*, New York, 1899), 'to account for the formation of geysers, but that of Professor Benson is now commonly accepted. It is as follows: In order to produce a geyser effect the outlet of the spring must consist of a natural tube, possibly of earth, rock, or deposits from the water itself, from forty to sixty or more feet in length, extending down into the earth. The tube being filled with water, the pressure exerted on that at the bottom increases its boiling point. Thus, while the water boils in the open air at 212° F., it would require a temperature of 251° F. to boil at the bottom of a tube at sixty feet of pressure. When a stratum of water at the bottom reaches this temperature it evolves steam, but the bubbles passing to the cooler water above are at once condensed. As the succeeding layers of superincumbent water become gradually heated to the boiling point, the escaping steam bubbles are condensed in turn in the layers of water higher up. The time comes, however, sooner or later, when the entire column of water to the top of the tube or to the surface reaches the boiling point, when much of the water throughout the entire tube is suddenly converted into steam, and the explosion occurs. . . . Some geysers observe absolute periodicity, so that the time of their eruptions may be foretold with exactness.' The intermittent spouting of certain other springs is due to the position of the aperture by which the water has to leave a subterranean chamber, and sometimes to other causes. In regard to the origin of thermal springs from the chemical, geological and physical-geographical points of view, see Armand Gautier, *Bulletin de l'Académie de Médecine* Paris, 1906, vol. lv. pp. 337-364.

arrangements to cool the water before it can be employed in baths ; for various domestic purposes, however, and for some trades, such waters, especially if the supply is abundant, as at Dax and Ax-les-Thermes, in France, Acqui, in Italy, and Caldas-de-Malavella and Caldas-de-Montbuy, in Spain, may be of considerable use.

Methods of classification.—Various classifications of mineral waters may be attempted. For instance, they may be arranged according to their natural temperatures, according to their chemical constituents, according to their 'chemical-physical' properties, or according to their therapeutic action.¹ All classifications have their disadvantages, but the division into groups, according to the chief active chemical constituents of the different waters,² is found most convenient, and is adopted in some form or other in nearly all works on mineral waters. This is the method of classification we have followed in the main, but in the case of thermal waters chiefly employed externally we have sometimes been influenced by therapeutic considerations. Thus, we have placed some thermal waters in the simple thermal group, though their mineralisation would have justified their presence in the earthy or another group, and we have considered this arrangement preferable in the case of waters almost exclusively employed externally when in their mode of action in the form of baths and douches they resemble simple thermal waters.

In electrolysis, as used in the process of electro-plating, the passage of the electrical current through a solution of a salt was supposed to split up the molecules of the salt into radicles termed 'ions' ('ionisation,' electrical 'dissociation'). Certain it is that the passage of the current causes one group of these radicles or 'ions' to move to the negative pole or kathode, whence they are called kations (or cations), and another group to the positive pole or anode, whence they are called anions. The kations include the metals sodium, potassium, silver, &c. ; whilst the anions include the acid radicles of salts. The term

¹ One of the best schemes of classification by therapeutic action is that given by Dr. W. R. Huggard in his recent *Handbook of Climatic Treatment, including Balneology* (London, 1906, p. 331). He first separates off waters for External use, and then divides those for Internal use into a Depurative group and a Tonic and Reconstituent group. The Depurative group comprises—(1) Abluent (simple thermal, sulphur); (2) Stomachic and Diuretic (including simple gaseous, simple alkaline, muriated alkaline, according to our nomenclature); (3) Mild Intestinal Stimulant (including our gaseous and non-gaseous muriated waters for internal use and our sulphated alkaline group); (4) Strong Aperient (our strong sulphated and muriated sulphated waters). The Tonic and Reconstituent group comprises—(1) Hæmatogenic (waters of which the most important ingredient is iron or lime); (2) Alterative and Nerve (waters of which the most important ingredient is arsenic or barium chloride).

² Cf. also M. Roloff, 'Physikalisch-chemische Grundlagen für die therapeutische Beurtheilung der Mineralwässer,' *Therapeutische Monatshefte*, Berlin, September and October, 1904.

'ion,' it may therefore be seen, is not synonymous with the term atom, for, as in the case of some acid radicles of salts, an 'ion' may be composed of more than one element. According to the theory of Arrhenius the molecules in a salt solution are not split up into ions by the passage of the electrical current, but the ionisation or dissociation is the necessary result of the condition of solution, the passage of the electrical current merely causing the 'ions' to move towards the electrodes. At any rate, the electrical conductivity of a solution seems to depend (other conditions being constant) on the number of free ions present. Pure distilled water will hardly conduct an electrical current. The best conductors are very weak solutions of salts. Thus, though free ions are supposed to exist in every solution, very dilute solutions are supposed to be the most perfectly 'ionised,' that is to say, in very dilute solutions the salt molecules are supposed to be held in solution almost entirely in a state of dissociation—as ions.

According to this the constitution of all very weakly mineralised mineral waters would be more correctly described if the *results of chemical analysis* were stated in 'ions' than if they were stated in terms of the salts supposed to be held in solution. Moreover, it might be argued that it is to the 'ions' rather than to the salts that many mineral waters owe their therapeutic effects. It must, indeed, be allowed that the therapeutic actions of many mineral waters have not been satisfactorily explained, but it is very doubtful whether the 'ion theory' is capable of affording the required explanations. Moreover, a statement of the salts contained in a mineral water often tells the ordinary medical man something of the nature and probable effects of the water in question, whilst the results of an analysis expressed in 'ions' would simply bewilder him. In this book we have therefore only referred to the results of analyses expressed in terms of the estimated amounts of the salts and gases in the mineral waters.

As it is probable that the *electrical conductivity* of a water (other conditions being the same) is dependent on the number of free ions in the water, electrical conductivity might be taken as a basis for the classification of mineral waters. Weakly mineralised waters (see previous remarks) show the most perfect ionisation of their mineral contents.

Osmotic pressure or tension.—Mineral waters might be classified (after H. Strauss¹ and others) according to their osmotic pressure (as estimated by the help of 'cryoscopy,' i.e. by deter-

¹ See H. Strauss, 'Ueber Beziehungen der Gefrierpunktsniedrigung von Mineralwässern zur Motilität und Secretion des Magens,' *Therapeutische Monatshefte*, Berlin, 1899, Jahrgang xiii. p. 582; and A. von Kostkewitz, 'Die Gefrierpunktsniedrigung der

mination of the freezing point¹) into (1) a hypertonic group, comprising those, notably the stronger 'bitter' waters, whose osmotic pressure is decidedly higher than that of the blood; (2) an isotonic group, including, for instance, those well-known springs at Tarasp, Karlsbad, Marienbad, Homburg, Kissingen, and Wiesbaden, whose osmotic pressure is not very different from that of the blood; and (3) a hypotonic group, comprising simple gaseous and weakly mineralised waters, and naturally also the relatively 'pure' chalybeate and sulphurous waters (in which the total of salts in solution is small), whose osmotic pressure is considerably lower than that of the blood. This question of osmotic action is obviously of especial importance in regard to mineral waters which are taken internally.²

The following figures give the depression of the freezing point (in degrees Celsius) of some of the best known mineral water springs of the European Continent as quoted in a recent paper by H. Loetscher:³ Friedrichshall 1·08°, Hunyadi János 1·047°, Apenta 1·015°, Bonifacius water of Salzschlirf 0·892°, Birmenstorf 0·752°, Saidschitz 0·75°, Lucius spring of Tarasp 0·68°, Elizabeth spring of Homburg 0·62°, Püllna 0·58°, Kochbrunnen of Wiesbaden 0·48°, Rakoczy spring of Kissingen 0·47°.

verschiedenen Mineralwässer im Vergleiche zu derjenigen des Blutes,' *ibid.* p. 577. Compare W. Roth and H. Strauss, 'Untersuchungen über den Mechanismus der Resorption und Secretion im menschlichen Magen,' *Zeitschr. für klin. Med.*, Berlin, 1899, vol. xxxvii. p. 144.

¹ At a constant temperature the osmotic pressure of a solution of salts is raised in proportion to the concentration of the molecules in solution, and when the concentration is the same the osmotic pressure rises in proportion to the rise of temperature. The freezing point of a solution of salts is depressed below that of the solvent in proportion to the concentration of the molecules in solution. But in regard to the influence of ionisation on the osmotic pressure and the freezing point, it is found that from the chemical-physical point of view each ion has to be regarded as a complete molecule, because physically it acts as such. Thus, the effect of ionisation of a salt solution is to raise the osmotic pressure and correspondingly to depress the freezing point as compared with the figures calculated out from the number of molecules which were actually dissolved in the solvent.

² See Hans Loetscher, 'Ueber die Bedeutung der modernen physikalischen Chemie, speziell der Iontentheorie für die Mineralwasser-Trinkkur,' *Annalen der Schweizerischen Balneologischen Gesellschaft*, Aarau, 1905, vol. i. p. 106; also E. H. Kisch, 'Neue Forschungen über die chemisch-physikalische Wirkungsweise der Mineralwässer,' a communication read at the fourth scientific congress of the Central Association of Balneologists of Austria in October 1904. See also W. Roth and H. Strauss, *Zeit. für klin. Med.*, loc. cit.; and H. Strauss, 'Der Einfluss von Kryoskopie und Ionenlehre auf die praktische Therapie,' *Zeitschrift für phys. und diät. Therapie*, Leipzig, 1906, vol. x. pp. 25 &c. Compare, however, B. Tausz, 'Können wir den Einfluss der Mineralwässer auf die Magenfunktion auf Grund physikalischer Gesetze erklären?' *Berliner klin. Woch.*, 1906, No. 22, p. 743. On chemical-physical phenomena see also the introductory portion of Bain and Edgcombe's work on Harrogate Waters, 1905.

³ H. Loetscher, loc. cit. Compare the figures given by A. von Kostkewitz, 'Die Gefrierpunktsniedrigung der verschiedenen Mineralwässer im Vergleiche zu derjenigen des Blutes,' *Therapeutische Monatshefte*, Berlin, 1899, Jahrgang xiii. p. 577.

Ferdinand spring of Marienbad 0.46° , Sprudel of Karlsbad 0.275° , Mühlbrunnen of Karlsbad 0.270° . The depression of the freezing point in the simple gaseous or 'table' waters, such as Apollinaris, Giesshübl, Gerolstein, is only 0.007° to 0.24° . With these figures Loetscher compares those for human blood (average 0.56° , according to Kümmel, Koranyi, &c.) and for the contents of the stomach at the height of digestion after meat meals (0.35° to 0.60°).¹ According to Lucien-Graux² and Casciani³ the following figures show the depression of the freezing point in several other well-known European waters, chiefly French and Italian:—Fiuggi (Italy) 0.005° , Bagnoles-de-l'Orne 0.009° , Source Cachat of Evian 0.024° , Source La-Raillière of Cauterets 0.025° , Grando Source of Vittel 0.030° , Saint-Honoré 0.035° , Source Vieille of Eaux-Bonnes 0.039° , Source du Prieuré of Saint-Christau 0.045° , Source No. 1 of Martigny-les-Bains 0.050° , Source Cotte of Enghien 0.058° , Source Saint-Jean of Vals 0.065° , Source du Pavillon of Contrexéville 0.069° , Source Madeleine of Mont-Dore 0.100° , Challes 0.100° , Source Badoit of Saint-Galmier 0.105° , weak Levico water 0.106° , Roncigno water 0.106° , Civillina water 0.146° , strong Levico water 0.146° , Source Saint-Léger of Pougues 0.158° , Source César of Royat 0.175° , Source des Célestins of Vichy 0.220° , Brides-les-Bains 0.245° , Source Eugénie of Royat 0.252° , Source La-Favorite of Vals 0.265° , Source Perrière-Choussy of La-Bourboule 0.317° , Source Gubler of Châtel-Guyon 0.338° , Source du Mont-Cornadore of Saint-Nectaire 0.390° , Tettuccio water of Montecatini 0.471° , Uriage-les-Bains 0.590° , Source Eau-Verte of Montmirail 0.735° , Rubinat water (Spain) 1.295° , Carabana water (Spain) 1.440° ; the freezing point of Villacabras water (Spain) is still lower.

Radio-activity.—It is conceivable that in the future certain groups of waters, including the simple thermal and thermal sulphurous waters, especially those mainly used for baths and external applications, might be classified according to the radio-active properties of the waters when obtained fresh from the spring-heads. Some of the simple thermal group seem to possess the greatest degree of radio-activity.⁴ Following are the amounts of radio-activity in various thermal and mineral waters measured in ESE according to a recent paper by Dr. L. Wick⁵: The

¹ Osmotic pressure can be recorded in terms of atmospheric pressure, and it has been found that a saline solution the freezing point of which shows a depression of 1° C. has an osmotic pressure equal to that of 12.05 atmospheres.

² *Application de la Cryoscopie à l'Étude des Eaux Minérales*, Paris, 1905.

³ Congress on Hydrology at Venice, 1905; quoted by Lucien-Graux, *loc. cit.*

⁴ Curie and Laborde, *Comptes rendus de l'Académie des Sciences*, May 9, 1904, vol. cxxxviii. p. 1150.

⁵ See L. Wick, 'Ueber die Beziehungen der Radiumemanation in der Gasteiner Therme zu deren Heilkraft,' *Berliner klinische Wochenschrift*, April 9, 1906, No. 15, p. 475. Many of Wick's figures are quoted from the writings of H. Mache on the radio-activity of the thermal waters of Gastein &c. On the radio-activity in the thermal springs and mineral waters of the Black Forest in Germany, and on the whole question of radio-activity in mineral waters, see H. Sieveking, 'Die Radio-aktivität der Mineralquellen,' *Berliner klin. Wochenschrift*, 1906, Nos. 23 and 24. By

large springs of Gastein at Bad-Gastein, 24·7 to 155·0; the Gastein water after it reaches Hof-Gastein, five miles distant, 4·4; Karlsbad, Mühlbrunnen, 3·1 to 31·5; Karlsbad, Schlossbrunnen, 17·4; Karlsbad, Felsenquelle, 4·1; Karlsbad, Marktbrunnen, 2·4; Karlsbad, Sprudel, 0·1; Marienbad, Kreuzbrunnen, 4·2; Marienbad, Ferdinandsbrunnen, 0·6; Franzensbad, Franzensquelle, 4·8; Franzensbad, Salzquelle, 0·13; Teplitz-Schönau, Steinbadquelle, 6·5; Teplitz-Schönau, Schlangenbadquelle, 6·5; Teplitz-Schönau, Urquelle, 4·9; Baden in Austria, the Ursprung, 3·1; Baden in Austria, the Franzensbad, 7·8; Vooslau, Hauptquelle, 0·7; Rohitsch-Sauerbrunn, Tempelquelle, 0·2; Pystjan or Pistyan, the Brunnenschacht, 2·0; Baden-Baden, Murquelle, 19·0; Baden-Baden, Büttquelle (not in use), 64·0; Kreuznach, 10·5; Wiesbaden, Kochbrunnen, 2·3. P. Curie made quantitative estimations of the radio-activity in various French thermal and mineral waters, including Plombières (several springs), Bains-les-Bains, Luxeuil, Vichy, Néris, Bagnoles-de-l'Orne, Salins-Moutiers, Cauterets, Faux Bonnes, Lamalou and Mont-Dore.¹ G. Vicentini and R. Alpago² have investigated the radio-activity of the springs of Abano and Battaglia in North Italy. In this connection it must be remembered that waters other than thermal and mineral springs may show traces of radio-activity. In fact, some ordinary springs used for drinking, and 'tap-waters' (see also p. 599), and even rain and snow (C. T. R. Wilson), have been found to possess radio-activity. So also have oil springs. The radio-activity of mineral water and other springs and the radio-active emanations in the lower layers of atmosphere arising from the soil are doubtless derived (cf. Elster and Geitel³ &c.) from minerals in the earth's crust containing radio-active 'elements': radium, thorium, uranium, polonium, or actinium.

Constituents of mineral waters.—The list of elements which have been recognised—at all events, in traces—as present in mineral waters is very large, but it will be here more practical⁴ to enumerate the chief chemical combinations in which the elements are supposed to occur dissolved in the waters. These are chloride of sodium (common salt), sulphate of sodium (Glauber's salt), sulphate of magnesium (Epsom salt), carbonate of sodium, sulphate

his apparatus the radio-activity of the Büttquelle at Baden-Baden seems not much less than that of the most radio-active Gastein springs (see footnote pp. 417, 418).

¹ Quoted by Hamaide, *Presse médicale*, Paris, 28 May 1904, p. 339. For investigations concerning the radio-activity of the sediments of several thermal and mineral springs of the French Alpine region, see G. A. Blanc, 'On Radio-activity of Mineral Springs,' *Philosophical Magazine*, January 1905, p. 148.

² *Atti del Reale Istit. Veneto di Scienze*, vol. lxiv.

³ 'Ueber Gewinnung vorübergehend radioaktiver Stoffe aus der atmosphärischen Luft,' *Physikalische Zeitschrift*, 1902.

⁴ See our previous paragraphs on the ionisation of mineral waters.

of calcium (gypsum), and carbonate of calcium (chalk). In small quantities there occur carbonate of iron (the protocarbonate or ferrous carbonate), sulphate of iron (both the protosulphate or ferrous sulphate and the persulphate or ferric sulphate), chloride of iron (the protochloride or ferrous chloride), and crenate of iron, the bromides and iodides of sodium, magnesium, and potassium, sulphides of sodium and calcium, arseniates of sodium, calcium, magnesium, and iron.

Together with the chlorides, carbonates, and sulphates previously mentioned are found the chlorides of calcium, magnesium, barium, strontium, lithium, potassium, ammonium, and manganese; the carbonates of magnesium, potassium, lithium, strontium, manganese, &c.; sulphates of potassium, aluminium, barium, copper, strontium, cobalt, nickel (Roncigno), and manganese; borates, nitrates, phosphates, and silicates; the occurrence of these salts in minute quantities or traces is generally of little therapeutic interest, but the chlorides of calcium, magnesium, and barium probably occur in sufficiently large quantities to exert some effect (see Chapter XIV). Other mineral substances are found in traces, including the rare metals cesium and rubidium, which were first detected through spectrum analysis (1860-1861) by Bunsen and Kirchhoff in the mineral waters of Dürkheim. In regard to the various elements detected in minute quantities in sea water (which is really a natural mineral water of the common salt group) we refer to our note on the subject at the end of Chapter XVIII. Some European sulphate of iron springs (e.g. Levico) contain a minute quantity of free sulphuric acid; one of this class of waters in America (Oak Orchard Acid Springs, Genesee County, New York) is said to contain as much as 2·3 per mille. Some specimens of sea water likewise contain traces of sulphuric acid.

Certain springs contain an admixture of naphtha or bituminous material, for instance, a spring at Ivonicz, in Galicia, the Source Vaikière at Clermont-Ferrand, the sulphurous Source Saint-Boès in the Pyrenees, the muriated springs of Salsomaggiore and Rivanazzano in Italy, the springs of Goriatchevodsk and Bragoun in the Caucasus, &c. In some waters, especially of the thermal sulphur and simple thermal groups, there are likewise organic and living organised substances, such as the jellylike *barégine*, which derives its name from being present in the waters of Barèges.

Gases present in mineral waters.—The most important gases dissolved in mineral waters are carbonic acid gas and sulphuretted hydrogen. Some waters contain an unusual amount of oxygen and nitrogen (Buxton, Lippspringe, Panticosa, &c.). The

inflammable carburetted hydrogen, or marsh gas, is occasionally found (Porretta and Acireale, &c.), and in the waters of Harkany, in Hungary, the inflammable gas, carbonyl sulphide, or oxy-sulphide of carbon (COS), was first discovered in the year 1867 by Karl von Than. In 1895 and the following years the chemically indifferent gas 'argon,' shortly after its discovery (1894), by Lord Rayleigh, as a constituent of atmospheric air, was found to be present in the thermal waters of Bath, Buxton, Wildbad, the old sulphur well of Harrogate, &c. Argon is present in waters which are fairly rich in free nitrogen. The gas 'helium,' previously to its discovery in certain minerals in 1895 by Sir William Ramsay, had been known to exist only by its band in the spectrum of the solar chromosphere, first discovered by Sir Norman Lockyer and Sir E. Frankland during the sun's eclipse of 1868; shortly after Sir W. Ramsay's discovery it was found to be present in association with argon in the waters of Bath and in some of the Cauterets waters.¹ Helium has been experimentally produced by Ramsay and F. Soddy from radium, so that the helium in thermal and mineral springs can now be regarded as a derivative from radium in the earth.

The classification which we have adopted is that into :

1. *Simple thermal group of mineral waters*.—Synonyms : 'indifferent thermal waters,' 'akratothermal waters,' 'eaux oligo-métalliques chaudes.' As the springs are frequently situated in wild mountainous regions and forests the name 'Wildbäder' (*Thermæ silvestres*) has also been given to simple thermal baths.²—These waters are poor in the amount of salts in solution, of low specific gravity, almost tasteless, of great transparency and softness. Their temperature lies generally between 80° F. and 150° F. Some contain an unusual amount of oxygen, some of nitrogen; argon and helium have also been found in waters of this group. There is no proof that the alkaline silicates in solution are present in sufficient quantity to exercise a decided medicinal effect. In regard to the electrical conductivity and 'ionisation' of weakly mineralised waters see previous paragraphs.

2. *Common salt or muriated (that is, chloride-containing) waters*.—The first name is derived from their chief solid con-

¹ See Sir W. Ramsay and M. Travers, *Proc. Royal Society*, vol. lx. pp. 442-448. For a bibliography of the subject of argon and helium in mineral waters see Dr. A. Poskin, 'Argon et Hélium dans les Eaux Minérales,' *Annales d'Hydrologie*, Paris, July 1904, vol. ix. p. 255. In regard to the production of helium from radium, see Ramsay and Soddy, *Proc. Roy. Soc. London*, 1904, vol. lxxii. p. 204, and vol. lxxiii. p. 346.

² Besides the typical Wildbäder, such as Wildbad in Würtemberg and Wildbad-Gastein, rural resorts with cold (earthy, sulphurous, &c.) springs have likewise sometimes been termed Wildbäder, for instance, in Bavaria: Wildbad-Burgbernheim, Wildbad-Wemding, Wildbad-Empfing, Wildbad-Adelholzen, Wildbad-Rothenburg, Wildbad-Neumarkt, Wildbad-Kreuth; and in Tirol: Wildbad-Innichen.

stituent—common salt—which, however, is likewise present in many waters of the other groups. The second name, 'Muriated or Chloride-containing Waters,'¹ is preferable on account of the presence, sometimes in appreciable amount, of other chlorides (the chlorides of calcium, barium, magnesium, lithium, potassium, and strontium). As the term *muriate*, signifying chloride, is obsolete in chemistry, some, such as Burney Yeo, would prefer the term 'chloride waters' to 'muriated waters.' There are, however, objections to almost every term.

Many waters of this group are rich in free carbonic acid gas. In addition to chlorides, small quantities of bromides and iodides (especially those of sodium and magnesium) are sometimes present; the amount of bicarbonate of iron occasionally deserves notice. These and other admixtures may modify the action of the common salt. The proportion of common salt varies from 2 or 3 to about 300 per mille in these waters; in fact, there are waters, like those of Droitwich, which are really saturated solutions, so that heating them leads to precipitation of some of the salt. The stronger muriated waters (brines, 'Soolen') are almost all cold and non-gaseous, and are used for brine baths ('Soolbäder'), after preparatory warming.² There are likewise in this group certain warm gaseous waters (Nauheim, Oeynhausen) of moderate strength in common salt, which can be used for giving warm effervescent baths ('Thermal-Soolbäder').

3. *Alkaline waters*.—Nearly all mineral waters, if the free carbonic acid gas which may be present is removed, give an alkaline reaction, but the present group receives its name because carbonate (bicarbonate) of sodium is a chief constituent. These waters almost always contain a considerable amount of free carbonic acid gas, and according to the presence or absence of much chloride of sodium or sulphate of sodium may be subdivided into three classes:

- (a) Simple alkaline waters.
- (b) Muriated alkaline waters.
- (c) Sulphated alkaline waters.

¹ It would, perhaps, be more strictly correct to keep to the older nomenclature, and call these waters 'Muriated Saline Waters,' that is, mineral waters, the *salts* dissolved in which are chlorides (*muriates*). On the other hand, the term 'muriated' has the advantage of being shorter than 'muriated saline,' and a shorter term is preferable, especially when speaking of compound mineral waters, such as muriated chalybeate, muriated alkaline, &c. Moreover, the term 'saline' is often used both in England and Germany in special reference to the purgative salts sulphate of sodium and sulphate of magnesium, and thus 'muriated saline waters' might be wrongly understood to mean the waters which we have here called 'muriated sulphated.'

² The term 'Soolen' (brines) should, strictly speaking, not be applied unless the waters in question contain at least 1·5 per cent. of common salt, and have a specific gravity of more than 1·050.

4. *Sulphated and muriated sulphated waters*.—In these sulphate of magnesium and sulphate of sodium, with or without common salt, are the chief ingredients. Those tasting of the bitter magnesium are commonly termed 'bitter waters.' Most of this group are used as aperient waters at home, but some of the less strongly mineralised muriated sulphated waters (Brides-les-Bains, Leamington, &c.) are used at the spas themselves.

5. *Iron or chalybeate waters*.—This group includes those waters in which iron is contained in sufficient amount to confer on them a therapeutic action. The iron in mineral waters is usually contained in the medicinally more valuable form of the bicarbonate, more rarely it occurs as protosulphate (ferrous sulphate), persulphate (ferric sulphate), or protochloride (ferrous chloride). Occasionally it is associated with the presence of arsenic. Alum is often present in sulphate of iron waters. Chloride of iron occurs in some common salt waters, and in association with barium chloride and calcium chloride as well as common salt in the 'chloride of iron spring' at Harrogate.

6. *Arsenical waters*.—Waters which contain a sufficient amount of arsenic to exert a special therapeutic effect are conveniently classed in a group by themselves. In some waters, however, as those of Mont Dore, which have for convenience been placed in this group, it may be doubted whether the arsenic is present in sufficient quantity to exert any therapeutic action. In the stronger waters of this group the arsenic generally accompanies sulphate of iron, but it may likewise occur in association with bicarbonate of iron, chloride and bicarbonate of sodium, &c.

7. *Sulphur waters*.—These contain sulphuretted hydrogen or a sulphide of sodium, calcium, potassium, or magnesium, in appreciable amount. Some are thermal, others cold. Some are simple, others are compound, containing an admixture of common salt or other salts sufficient in amount to exercise an influence on their therapeutic action. The total of solids found in solution in sulphur waters is, however, usually very small, and especially is this the case in the sulphide of sodium group, of which the Pyrenean sulphur spas (Bagnères-de-Luchon, Cauterets, &c.) may be considered the representatives.

Low forms of living organisms flourish in the thermal sulphur waters, especially those belonging to the vegetable world (such as aquatic fission-fungi, *Beggiatoa alba*, *Thiothrix nivea*, *Byssus lanuginosa*), and these give rise to the flaky, jelly-like substances, called glairine, barégine &c. usually found in this class of waters. Calcium sulphide, when occurring in waters containing sulphate of calcium, is supposed by certain authorities (v. Egasse and

Guyenot, *Eaux Minérales de France*, 1891, p. 30) to be sometimes due to the passage of these waters through soil rich in organic material, which, by withdrawing the oxygen from the sulphate, they suppose gives rise to the sulphide. It should be noted that waters in marshy districts may contain sulphuretted hydrogen, resulting from the decomposition of vegetable matter.

8. *Earthy or calcareous waters*.—Here the chief constituents are carbonate and sulphate of calcium, and carbonate of magnesium. These waters may be termed '*alkaline earthy waters*' when carbonates of calcium and magnesium are the chief constituents, and may be termed '*gypsum waters*' when sulphate of calcium forms the chief constituent. Many earthy waters contain varying amounts of iron, sulphur, common salts, &c., sometimes making it necessary to give them likewise a place in other groups. Waters containing both bicarbonate of sodium and bicarbonate of calcium (French: *eaux bicarbonatées mixtes*) may be classed as members either of the simple alkaline or of the alkaline earthy group, according to the preponderance of the former or the latter amongst their mineral constituents.

9. *Table waters and other very weakly mineralised cold waters*.—Cold waters belonging to one or other of the preceding groups, but very weakly mineralised, often form pleasant '*table waters*' on account of the carbonic acid gas they contain, and are classed as a separate group, analogous to the simple thermal group, but cold and generally gaseous. To this group may be added some other weakly mineralised cold waters (French: *eaux oligo-métalliques froides*), which can hardly be classed in one of the previous groups, but still deserve notice on account of a special therapeutic influence attributed to them. Such waters are those of Krankenheil, with a total mineralisation of about 1 per mille (containing a minute quantity of iodide of sodium), and those of Saint-Christau, in the French Pyrenees, interesting for the minute quantity of sulphate of copper they contain, though their total mineralisation is only about 0.3 per mille.

Possible importance of the presence of very minute amounts of salts in mineral waters, questions of radio-activity, 'mineral enzymes,' &c.—We have not thought it necessary or advisable to give complete analyses of the different mineral waters mentioned in the book, but have confined ourselves to noting the relative amounts of the chief constituents. It must be confessed, however, that minute quantities (for instance, minute quantities of arsenic and iodine), apparently too insignificant to deserve mention, may ultimately turn out to have a real importance, combined as they are with numerous other ingredients in natural mineral waters. The following is a single instance of the difficulties which con-

stantly arise. Dr. R. Saundby (Article on Diabetes Mellitus, in Allbutt's *System of Medicine*, vol. iii. 1897, p. 227), in referring to the waters of Neuenahr, gives common salt amongst the three ingredients he selects as worthy of mention. The amount present in the Grosser Sprudel is 0.1 gramme in the litre, according to Fresenius and Hintz, that is, only seven grains in the Imperial gallon. We have not thought it necessary to note this minute quantity, but the possibility that it may ultimately be shown to have some importance must be admitted.

It must be remembered, also, that radio-activity, especially radium emanation (of which Ramsay and Soddy have shown that helium is a product of decomposition), may be present in mineral waters. W. Meyerhoffer¹ refers to possible traces of so-called 'mineral enzymes' which might have effects analogous to the catalytic action of finely divided platinum and colloidal metallic solutions. He draws attention to the fact that the proportion of gold in sea water² is much greater than that of platinum in Bredig's fluids, which can exercise a distinct catalytic effect.³ P. Curie (discoverer of radium) and A. Laborde and others⁴ estimated the

¹ *Die chemisch-physikalische Beschaffenheit der Heilquellen* (Hamburg, 1902), a lecture delivered before the Seventy-fourth Congress of German Naturalists and Physicians, held at Karlsbad in 1902.

² It has, we believe, been seriously suggested that gold might be extracted from sea water for commercial profit!

³ In regard to the catalytic action (that is, ferment or enzyme action) exercised by Bredig's fluids, see also 'The Action of Metallic Ferments on Metabolism,' by Professor Albert Robin of Paris, *International Clinics*, Lippincott Company, 1905, vol. iii. p. 39. Bredig and his pupils showed that when a small electric current is made to pass between metallic electrodes immersed in distilled water, a solution of the metal is obtained containing between 0.09 and 0.2 milligramme of the metal used to each cubic centimetre of water. They found that such solutions show certain of the reactions of organic diastases, and that these reactions can be either accelerated or inhibited by agents capable of exerting an analogous influence on the diastases. Robin made subcutaneous injections of similar metallic solutions in man and concluded that metals in extreme subdivision are capable of remarkable physiological action, out of all proportion to the amount of metal used. The solutions employed by Robin contained a few thousandths of a gramme of a metal, such as palladium, platinum, gold, silver, &c. See also A. Robin and G. Bardet, 'Action des métaux à l'état colloïdal et des oxydases artificielles sur l'évolution des maladies infectieuses,' *Comptes rendus hebdom. de l'Académie des Sciences*, Paris, 1904, vol. cxxxviii. p. 783.

⁴ See Curie and Laborde, 'Sur la radioactivité des gaz qui se dégagent de l'eau des sources thermales,' *Comptes rendus de l'Académie des Sciences*, May 9, 1904, vol. cxxxviii. p. 1150. See also E. H. Riesenfeld's summary, 'Vom Radiumgehalt der Heilquellen und Moorerden,' *Deut. med. Woch.* 1905, No. 1, p. 19. Our present knowledge on the subject of radio-activity in mineral and other waters and their sediments and on the subject of radio-active emanations from the soil into the atmosphere is due to the work of P. Curie, the discoverer of radium, Sir W. Ramsay and F. Soddy, who produced helium from radium, J. Elster and H. Geitel (relation of radium in the earth and in mineral muds—fango &c.—and in mineral water deposits to the radio-activity of springs and of ground air), R. J. Strutt (who first proved the presence of radium in the ferruginous deposits left by the thermal springs of Bath, in England), Lord Blythwood and H. S. Allen (who first showed the presence of radium emanation in the thermal water of Buxton, in England), H. Mache (the springs of

radio-activity of the gases and waters of thermal springs. They found this greatest in certain springs of the 'simple thermal' class, such as Gastein in Austria and Plombières in the Vosges Mountains in France,¹ and they suggest that such springs may owe special therapeutic effects to radio-activity. They point out also that rapid loss of radio-active emanations might account for the fact that certain waters have a more beneficial effect when fresh from the spring than after having been stored up² for some time. On this subject we would refer to the interesting observations of Bergell and Bickel concerning the effect of the loss of radio-active emanations in regard to the internal use of the Wiesbaden Kochbrunnen water.³

Since radium and other radio-active substances occur in the sediment⁴ and deposits of some springs, one would naturally

Gastein &c.), J. J. Thomson (ordinary tap-water), F. Dienert (ordinary water used for drinking in the city of Paris), C. T. R. Wilson (rain and snow), Snaake (radio-activity in the atmosphere at high-altitude localities), and other investigators in different countries.

¹ Weakly mineralised thermal muriated waters, such as those of Baden-Baden in Germany and Bourbon-Lancy in France, which in character and action approach the simple thermal group, may also show great radio-activity. In fact, the Büttquelle of Baden-Baden in this respect rivals some of the most radio-active springs of Gastein. Of Bourbon-Lancy springs, according to A. Piatot, the least mineralised are the most radio-active.

² A. J. Kalmann ('Contribution à l'action biologique des sources thermales radio-actives,' *Le Radium*, Paris, 15th August, 1905, p. 259), writes: 'Un grand nombre de recherches préalables avaient démontré que l'eau thermale embouteillée plus de 4 jours, ne possédait point d'autres propriétés que celles présentées par l'eau potable ordinaire.' Again (p. 262), as one of the conclusions of his investigations, he writes: 'L'action de cette émanation fait complètement défaut si l'on se sert d'eau de source âgée de plus de 48 heures ou de gaz de ces sources provenant d'eau embouteillée depuis plus de 8 jours.' M. Rheinbold (*Berliner klinische Wochenschrift*, 1906, No. 20), in an article on the 'Bactericidal Action of Radio-active Mineral Water,' claims that freshly obtained water from the Rakoczy spring at Kissingen exercises an inhibitory action on the growth of *Bacillus prodigiosus*, though samples of the water which have been kept for some time show no such action. He believes that this phenomenon can be explained by the presence of radium emanation in the fresh water and by their absence in the water which has been kept.

³ See P. Bergell and A. Bickel, 'Experimentelle Untersuchungen über die physiologische Bedeutung der Radioaktivität der Mineralwässer,' *Zeitschrift für klinische Medizin*, Berlin, 1906, vol. lviii. p. 235. According to Bergell and Bickel, who examined the action [on proteolytic ferments] of the Wiesbaden Kochbrunnen water before and after the loss of its radio-active emanations, it seems that the radio-active properties of mineral waters when used internally favour the action of the pepsin digestion. See also F. Bernard (of Plombières), 'De l'état actuel de nos connaissances sur les phénomènes attribuables à l'action radio-thérapique des eaux minérales,' 1905. See also L. Wick, 'Ueber die Beziehungen der Radiumemanation in der Gasteiner Therme zu deren Heilkraft,' *Berliner klin. Wochenschrift*, 1906, Nos. 15 and 17; also A. J. Kalmann, 'Contribution à l'action biologique des source thermales radioactives,' *Le Radium*, Paris, 15 August 1905, p. 259.

⁴ Radio-active substances have been detected in the deposits from springs at Bath in England; at Baden-Baden, Nauheim, Kreuznach and Wiesbaden (see Chapter XVIII); at Karlsbad in Bohemia; and in several French springs. G. A. Blanc (*Philosophical Magazine*, January 1905, p. 148), who investigated the radio-active

expect them also to be present in some of the mineral muds used for mud baths. It is not therefore surprising that the mud (fango) of Battaglia in Italy, and, according to I. I. Borgman (1904), the muds of Arensburg and Kuyalnitsk in Russia possess radio-active properties. In this paragraph, however, we are digressing from our present subject. The action of mud baths will be considered in the following chapter.

Defects in classification.—A difficulty often arising is that of deciding what proportion of an ingredient must be considered as the necessary standard to justify the classification of a given mineral water in some particular group. In this respect it is impossible to exactly follow a definite rule, for old customs must to some extent be respected. Let us take bicarbonate of iron waters as an example. We have considered that the presence of 0.02 gramme of bicarbonate of iron in the litre (1.4 grains in the Imperial gallon) qualifies a water for being mentioned in the chalybeate group. On the other hand, some waters have for the sake of old custom &c. been placed in this group, though the amount of iron they contain is decidedly less than the standard we have fixed on.

No classification of natural mineral waters, however elaborate, can be really perfect; for, in their constituents and the relative proportion of the constituents, they present infinite varieties. The classification which has been here adopted is, however, believed to be that which is practically found to be most convenient for reference and memory. Several of the spas should be mentioned under two or three different groups, either on account of the same spa possessing mineral springs which belong to different groups, or on account of a single spring in the character of its active chemical constituents falling between two or more groups.

properties of the materials deposited by various thermal springs and mineral waters of the Alpine region of France, found radio-activity in the 'barégine' and in the hard grey sediment from the 'Alum spring' of Aix-les-Bains, and in the sediments from springs at Echaillon, Salins-Montiers, Allevard, Challes, &c. Blanc concluded that, besides traces of radium, the deposits from some of the French waters contain another radio-active constituent, probably thorium. It appears (investigations of Elster and Geitel &c.) that in the water and gases from springs, though radio-active emanations occur, no radio-active mineral substances have been detected, but the latter (actual radium, thorium &c.) may be present in the spring deposits and mineral muds ('fango' of Battaglia &c.). The constituent or constituents to which the radio-activity is due may be ascertained by the rate at which the radio-active properties are lost and by the duration of the 'induced' radio-activity. According to E. H. Riesenfeld (*Deut. med. Wochenschrift*, 1905, No. 1, p. 20), there is no evidence of the actual presence of radio-active minerals in the peats used for the 'Moorbäder' of Franzensbad and Karlsbad; at all events, their radium content is not greater than that of ordinary soil, and Riesenfeld compares the premature attempt to ascribe the therapeutic effects of Moorbäder to radio-activity with the attempt to attribute the beneficial action of woodland resorts to ozone in the air (see Part I, Chapter I).

CHAPTER XIV

ACTION OF MINERAL WATERS ON THE ORGANISM
IN THEIR EXTERNAL AND THEIR INTERNAL EMPLOYMENT

EXTERNAL USE

MINERAL waters when not rich in salts and gases, if applied in the form of baths (this term being used in its broadest sense to include the various forms of douches,¹ &c.), exert probably nearly the same effect as simple water would when applied in the same manner and at the same temperature. The effects of the external application of simple water have been already discussed (Chapter XII). Most mineral water baths are either naturally warm, or are artificially warmed for use; warm and tepid baths promote and equalise the circulation of blood in the cutaneous vessels, macerate the epidermis and have a greater cleansing effect (especially the alkaline baths) than cold baths; they thus also promote the excretion of the cutaneous glands. This diaphoretic effect is, of course, much increased in very hot baths and in vapour baths (Monsummano in Tuscany, and other 'natural vapour baths'²). Very many mineral water baths are given at tepid

¹ The various *local* external uses which mineral waters have been put to at one spa or another are very manifold. Amongst them are, firstly, all kinds of ordinary local douches, the local vapour bath (Berthollet system), the local douche-massage, the rectal douche ('douche ascendante'), the vaginal douche ('douche interne'), and the perineal douche. At many spas the waters are employed for gargling, for nasal douches, for pharyngeal douches, and sometimes for eye douches, and for spraying the pharynx, eye, or skin of the face. Mineral waters are likewise sometimes employed for lavage of the stomach (as at Vichy), lavage of the large intestine with the patient lying on a couch ('douche horizontale,' as opposed to 'douche ascendante' with the patient seated on a stool), and even for washing out the urinary bladder. In the majority of these cases ordinary water (medicated or not to suit the individual case) would probably answer the requirements.

² Most spas possess arrangements for giving hot vapour baths, general and local. In many cases the hot vapour baths, although the chambers in which they are given are not natural caverns like the grotto of Monsummano and some other Italian 'stufe,' are still called 'natural,' because only the natural thermal water is used to produce the hot vapour. Amongst the 'stufe' or (more or less) natural vapour baths are the Italian ones of Monsummano, Battaglia, Vinadio, San Germano (Agnano), Bagni di Nerone (near Pozzuoli), those of the Island of Ischia, that of Sciacca in Sicily, and that of Szklens in Hungary. With these may be classed the natural vapour baths (crevices) on the side of Le Montet at Cransac, in France. At Cransac and San Germano there is an admixture of sulphuretted hydrogen with the vapour. In the mountain-side of the 'Stinkberg' of Torja, near Tusnad (see Chapter XXIII), in

temperatures; such a bath constitutes a medium of uniform temperature enveloping the body, and in the case of weakly mineralised, non-gaseous waters, acts in great part by its soothing effect on the peripheral nerve-endings in the skin, equalising the distribution of blood, &c.

Radio-activity.—We will not repeat all that we said in the previous chapter regarding radio-activity in mineral waters. It seems that some of the least mineralised springs, such as those of Gastein in Austria and Plombières in France, show the greatest amount of radio-activity. These simple thermal and similar 'weak' waters are chiefly employed in the form of baths and douches, and it is just possible that some of the therapeutic effect derived from external treatment with such waters may depend upon radio-activity,¹ but one cannot venture to say more than this at present. The same considerations apply to the therapeutic effects of the local application of certain mineral water sediments and mud baths, and to this we shall refer again presently.

Absorption from baths.—In the course of a bath it has been found that hardly any water is absorbed through the skin. Increased diuresis, when it follows baths, must be caused, firstly, by diminished loss of fluid through the skin, and, secondly, by reflex vaso-motor effects due to stimulation of the cutaneous nerve-endings; at one time, however, it was taken as evidence that much water had been absorbed into the circulation from the bath. Salts dissolved in the bath were formerly likewise supposed to be absorbed through the skin, but experiments have failed to prove this, except by the action of electrolysis in the case of various salts dissolved in the bath water.² Doubtless salts may pass through any portion of mucous membrane with which they come in contact, but are not absorbed, in any appreciable amount at least, by the healthy skin.³ Salts dissolved in the bath water may, how-

Transylvania, there is a cavern which not only contains sulphuretted hydrogen but also a layer of carbonic acid gas, as in the 'Grotte del Cane' of Italy.

¹ Cf. L. Wick, 'Ueber die Beziehungen der Radiumemanation in der Gasteiner Therme zu deren Heilkraft,' *Berliner klinische Wochenschrift*, 1906, Nos. 15, 16. The term 'Gastein baths' has already been employed as synonymous with 'radio-active baths' (cf. 'artificial Gastein baths,' p. 351). See also Chapters XIII and XVII.

² When salts, such as sodium chloride or salicylate, are dissolved in the bath-water, the 'ions' of chlorine &c. can be made to pass through the skin at the site of the kathode. See P. Hartenberg, *Presse Médicale*, Paris, January 17, 1906, p. 34; in regard to the resolution of cicatricial tissue by the aid of electrolytic methods, see S. Leduc, *ibid.*, September 22, 1906, p. 605. In Chapter XII we have alluded to some observations of Dr. F. W. Smith on the use of electrolysis in Harrogate sulphur water baths.

³ The absorption of drugs when applied to the healthy skin in the form of ointments or oils cannot be adduced as evidence against this, for these are rubbed or pressed into the skin. Mercury is so easily volatilised that when several patients are being treated by mercury baths &c. other patients in the same room may, it appears, present signs of mercurialism. There may, however, be great differences in regard to

ever, penetrate into or be imbibed by¹ the epidermis (especially if the skin is comparatively free from greasy material, as the palms of the hands and the soles of the feet are owing to the absence there of sebaceous glands), and by coming in contact with the outermost nerve-endings, impart a stimulating effect to the bath. The special stimulating effect of brine baths ('Soolbäder') is chiefly, if not entirely, due to this action. Thus, in ordinary brine baths the degree of stimulation, as far as any individual patient is concerned, must vary according to the percentage of common salt (and other salts when Mutterlauge is added) in the mineral water, and according to the temperature and duration of the bath.

D. Rothschild and H. Hughes find that (hypertonic) salt baths tend to increase the osmotic pressure of the blood, whilst baths of plain water tend to diminish it. Hughes thinks that these observations help to explain why salt baths can hasten the reabsorption of material which has exuded from the blood, such as the remnants of pleuritic effusions, &c.²

Effect of gases in bath water.—Gases dissolved in a bath may pass into the circulation, as has been proved in the case of sulphuretted hydrogen gas. That the sulphuretted hydrogen absorbed in this way from the water of sulphur springs is sufficient in quantity to have any therapeutic effect is very doubtful. Still less is it likely that the free carbonic acid gas, in which some baths are rich, can exert any action by absorption through the skin, for owing to the pressure of the CO₂ already present in the blood, very little more is likely to enter from the bath water through the skin. Some of it may be inhaled as it escapes from the bath, but the special stimulating effect of gaseous 'iron baths,' such as those of Spa, Schwalbach, &c., is probably chiefly due to the mechanical effect of the bubbles of carbonic acid gas. Far

cutaneous absorption in different individuals, for there can be no doubt that compresses of carbolic acid solution, applied to quite healthy skin, sometimes lead to absorption of carbolic acid into the circulation (as shown by the urine), and occasionally, even, give rise to some of the symptoms of carbolic acid poisoning (such as were noted by R. C. Lucas and A. Lane in the *Lancet*, June 1, 1895, and August 28, 1897). These results may depend partly on idiosyncrasy, but are doubtless in part due to the removal of the sebaceous material from the skin by soap and water or ether before applying the antiseptic compresses in question. Dr. S. Hyde (*Buxton: Its Baths and Climate*, fourth edition, pp. 47 and 58) has actually suggested gently rubbing the skin with a volatile spirit to dissolve the fatty matters and thus promote absorption in baths.

¹ Skin eruptions following bathing in salt or sea water may partly perhaps be due to particles of salt remaining in interstices of the epidermis after drying the body. Such particles in the skin afford an explanation for the possibility of a stimulating effect on the heart's action &c. being observed to last for some time after the bath is over. *Vide* Ph. Wagner, *Das Solbad Salzungen*, fourth edition, p. 36.

² See Rothschild and Hughes, 'Einfluss der Mineralbäder auf den osmotischen Druck des Blutes,' a communication to the Balneologengesellschaft, Frankfurt-a.-M., March 1900; also Hughes, *Deutsche Medizinal-Zeitung*, 1900, No. 42.

from being absorbed, the small bubbles may be seen to collect in myriads on the immersed part; then larger bubbles begin to be formed by the coalescence of smaller ones, and these creep along the skin towards the surface of the bath, giving rise to a peculiar sensation of tickling, prickling, and warmth, and exercising a mechanically stimulating action on the endings of the cutaneous nerves. The stimulating effect of the warm gaseous salt baths of Nauheim and Oeynhausen is partly due to a similar action of the gas, and it is this effect of the gas that enables gaseous baths to be taken at a somewhat lower temperature than baths of non-gaseous waters, without giving rise to any sensation of cold. Baths of other gaseous effervescent mineral waters may to some extent be employed in the class of cases treated by the Nauheim baths (see Chapter XVIII). Thus the tepid gaseous waters of Salins-Moutiers and of Royat could be so used, as well as the cold gaseous waters of Spa, Schwalbach, St. Moritz, Cudowa, Marienbad, Tarasp, Kissingen (Schörsborn-Sprudel), Homburg &c. if properly warmed. Artificial 'Thermal-Soolbäder' are made by various (Lippert, Mack, Kiefer-Fischer, Keller, Sandow, Guaglio) methods of producing a carbonic acid effervescence in warm salt baths.

To explain the action of Nauheim and other baths¹ in cardiac affections, it has been suggested that the vagus nerve is reflexly stimulated, and that thus a tonic effect is produced on the heart, giving rise to a temporary alteration in its movements, and that this may have a beneficial influence on the cardiac nutrition, comparable to that which mild gymnastic exercise brings about in the case of voluntary muscles. The ultimate good effect of a course of these baths is probably partly due to an increased power of excreting the waste products of metabolism, which a deficient circulation has allowed to accumulate in the blood and tissues of the body.

General conclusions.—If we shortly sum up the action of mineral water baths, we come to the following conclusions. They serve to keep the skin clean and active during the cure, and, in fact, to maintain it in the best possible condition. They exercise (especially those containing common salt or much car-

¹ In this connection it may be remembered that Dufresse de Chassigne wrote in 1859 on the effects of the hot baths of Bagnols in chronic cardiac affections, and in 1886 Dr. L. Blanc, of Aix-les-Bains, published a paper on thermal treatment in cases of rheumatic heart disease, a subject which he had already alluded to in an earlier paper. The special advantage which can be claimed for the Nauheim baths is that, owing to the effect of the carbonic acid gas, they may be administered at a lower temperature than baths of non-gaseous mineral waters. Dr. J. Jacob, of Cudowa, should likewise be mentioned amongst those who early recognised the value of baths in cardiac affections (*vide* Dr. A. Fundner's *Die Wirkung des kohlensäurehaltigen Mineralbades*, Leipzig, 1898).

bonic acid gas) an indirectly tonic action on the circulation and the general metabolism, promoting elimination by the kidneys of toxins and waste products, and thus preparing the tissues for the assimilation of fresh nutritive material. In this way the action of most mineral water baths and douches can be explained, whether simple thermal, gaseous thermal, sulphurous, muriated or muriated sulphurous, notably their effect in scrofulous, anæmic, and various cachectic conditions, as well as their powerful adjuvant action to specific treatment in cases of syphilis. In gouty conditions and the 'uric acid diathesis,' and in persons who have overfed and led a too sedentary life, their eliminative action is perhaps the most important. In irritable conditions of the nervous system the soothing influence of the less hot simple thermal waters, and in neuralgic and painful affections the analgesic effect of the very hot waters, are most sought after. In chronic cutaneous affections we must ascribe the action of baths and douches partly to their indirect influence on the general nutrition, as already mentioned, and partly to their effect on the cutaneous circulation, and their macerating, irritative, or mild antiseptic action on the skin, according to the kind of water employed, and according to the mode, duration, and frequency of the applications. We need not repeat here what we have said in a previous chapter as to the possible effects of radio-activity in mineral waters (when fresh from the well-head), notably those of the simple thermal class, but also some of other classes (especially the more weakly mineralised waters, such as the thermal muriated springs of Baden-Baden, some of which in regard to radio-activity rival the simple thermal springs of Gastein).

Gas baths and douches.—It may here be mentioned that gas baths of carbonic acid have been, and are, employed at some spas, the gas obtained from the mineral water being made use of for the purpose. The patient sits thinly clothed in an atmosphere of the gas, but either by a partition around the neck or by a properly placed overflow pipe care is taken that none of the gas is inhaled; the gas has likewise been employed as a local bath or douche to various parts of the body. In this form of local douches carbonic acid is said to have an anodyne effect in facial and temporal neuralgia, sciatica &c. provided that the skin over the painful parts is kept moist during the application of the gas. In the form of vaginal douches, the gas is said to be useful in some cases of vaginismus without inflammation, and to promote healing in cases of chronic ulceration of the cervix uteri. A healing action from the topical use of carbonic acid has been claimed in cases of chronic ulceration¹ of the legs, &c. Carbonic acid has

¹ See Dr. E. Salva in the *Gazette Médicale de Paris*, 1860 and 1861. In contradistinction to this we may mention that a powerful healing action has been claimed

been likewise employed as a pharyngeal douche in chronic granular pharyngitis, and for inhalation in cases of pulmonary emphysema. Here we may mention that the term 'gas bath' or 'carbonic acid gas bath' is sometimes incorrectly employed when a 'gaseous bath'—that is to say, a bath of a water rich in (and effervescent with) carbonic acid gas—is meant.

Baths of sulphuretted hydrogen gas, or rather of a mixture of the gases obtained from the spray of sulphuretted hydrogen waters, are sometimes employed in various cases. The utility of all gas baths remains doubtful. In the case of sulphuretted hydrogen baths, the temporary diminution of the pulse frequency, often observed, is doubtless due to inhalation of the gas. In some 'natural vapour baths' (*e.g.* the Stufe di San Germano, near Naples) the vapour contains an admixture of sulphuretted hydrogen.

Peat and mud baths.—Peat baths and mud baths are employed at a great number of spas on the Continent ('Moorbäder,' 'moor baths,' 'bains de tourbe,' 'Mineral-Moorbäder,' 'Eisen-Mineral-Moorbäder,' 'ferruginous peat baths,' 'Schlamm-bäder,' 'bains de boue,' 'fango baths,' 'Mineral Schlamm-bäder,' 'Schwefel-Moorschlamm-bäder,' 'Sulphur mud baths,' 'Salz-Schlamm-bäder,' 'Salt mud baths,' 'Marine mud baths,' 'Salz-Schwefelschlamm-bäder,' &c.).

There is no hard-and-fast division to be made between baths of fine mineral mud ('fango baths,' 'Mineral-Schlamm-bäder'), as employed at Battaglia &c. and baths of peat or earthy soil (humus) rich in vegetable material ('bains de tourbe,' 'Moorbäder'), as employed at Franzensbad, &c. Between these two extremes come baths of earthy or peaty mud ('Moorschlamm-bäder') such as those of Nenndorf, Eilsen, &c.

The peat or earth used for baths is usually dug out of the ground in the autumn, and placed in large reservoirs or heaps, where it remains exposed to the air until it is required for the 'moor baths' of the following bathing season. During this period a process of disintegration goes on, and important chemical changes take place. The disintegrated peat when ready for use consists of decaying plant matter and soil, and is more or less rich in soluble mineral salts, notably sulphate of iron; it contains likewise small amounts of free acids (sulphuric, acetic, and formic acids). Sulphate of iron is usually not found in the freshly dug peat, which, however, contains disulphide of iron. During the disintegration process part of this disulphide of iron (which is indirectly derived from the mineral water springs infiltrating the soil of the 'moor fields') becomes oxidised, so that sulphate of

by G. Stoker for local baths of oxygen in ordinary chronic ulceration of the legs, &c. A similar healing action has been claimed for ozone and peroxide of hydrogen.

iron and free sulphuric acid are formed,¹ and the acid thus set free induces further chemical changes in the other mineral and organic constituents of the peat. Some peats, such as those of Franzensbad and Marienbad in Bohemia, and of Lipetsk in Russia, are said to be particularly rich in iron. The peat baths are finally prepared for use with the mineral water of the locality, and artificially heated to the temperature required.²

For mud baths a substance is obtained from the thermal springs (the 'fango' of Battaglia), or from their neighbourhood (the 'fango' of Acqui and the mud of Saint-Amand), consisting of mineral salts (partly derived from the mineral water), organic matter and material derived from the neighbouring soil. At some spas (as at Dax) the mud used for the baths is formed by the action of the thermal water and living algæ and other organisms on materials deposited from periodical inundations of the river. The 'Schwefel-Moorschlammbäder' of Nenndorf, Milsen, Driburg, Meinberg, Wipfeld &c. are made by a natural or artificial mixture of the sulphurous mineral water with a peat-like mud. For the sulphurous mud baths of Pystjan, in Hungary, deposits of a very fine mud about the springs, saturated with the thermal sulphur water, are employed. Mud baths containing much common salt (Salz-Schlammbäder or Salz-Schwefelschlammbäder) are employed at Ischl and some 'Soolbäder.' Salt mud baths are likewise employed at Odessa, at the Crimean localities of Saki (or Ssaki), Moïnak, Sebastopol &c., and at various places on the Black Sea, along the northern shore of which the brine lakes, or 'limans,' are situated, from which the mud is obtained. The mud is considerably denser than the peats used at Franzensbad or Marienbad.

The administration of so-called 'natural mud baths' in the Crimea is peculiar, and the method employed at the old-established resort of Saki may be considered as the type.³ The mud taken (on the day before the bath) from the lake is placed on a slab forming what is termed a 'medallion' and is heated in the sun. The patient lies down at full length on this mud and is rapidly covered with it by the attendants, but the face and neck are left free, and in some cases the thorax and abdomen are covered by a folded sheet instead. A compress of fresh water (frequently renewed) is kept applied to the head, which is likewise protected by a sunshade. In about twenty minutes or less the mud is

¹ See 'Ueber den Franzensbader Mineralmoor,' by E. Ludwig, K. Hödlmoser, and Th. Panzer, *Wiener klinische Wochenschrift*, 1899, No. 17, p. 463.

² There are no naturally hot peat baths, and but few places can boast of a naturally hot mud supply.

³ See *Les Stations de Boues Minérales de la Russie d'Europe*, by Professor A. Scherbakov, Moscow, 1897.

washed off with warm salt water, and the face and delicate parts of the skin are bathed with fresh water. The patient is then wrapped up and has to lie down for about two hours, during which time abundant sweating takes place. In bad weather, when there is no sunshine, the 'natural mud baths' cannot be given, and diluted hot mud baths are employed indoors. An average course of treatment at Saki consists of about twelve mud baths, and is often followed by brine baths and sea bathing. More than one mud bath is never given on the same day, and in delicate subjects only one every other day. In the natural mud baths, the mean temperature of the mud varies according to atmospheric conditions, &c.; the sun may heat the outside of the mud up to 122° F. (=50° C.) or even more. With this account of the Crimean mud baths that of the mud (fango) baths of Acqui in Italy (see Chapter XXV) should be compared.

Action of peat and mud baths.—Semi-solid peat baths act as very large poultices to the surface of the body. Owing to the firm consistence of the material and the poor conduction of heat, the temperature of the layer of peat surrounding the bather, if the bather remains fairly motionless in one position, soon becomes nearly the same as that of the skin. Hence higher temperatures can be borne in peat baths than in water. (According to Kisch, a peat bath of 102·2° F. can be regarded as indifferent in temperature, i.e. as equivalent to about 89·6° F. in an ordinary bath.) The same applies to the action of heavy putty-like mud, such as the 'fango baths' of Acqui in Italy. Here the intense burning sensation which first results from the application of mud at 122° F. (50° C.) rapidly passes off as the layer immediately next the skin becomes of nearly the same temperature as the surface of the body. When, however, a limb covered by the fango is slightly moved and therefore the relative position of the mud to the skin changed, the intense heat is again felt. Besides the thermal action, the weight of peat baths and mud baths exercises some influence on the cutaneous circulation. Moreover, in peat baths the sulphate of iron and the other salts and acids have a chemically stimulating action on the cutaneous nerve-endings. Peat and mud are employed in chronic rheumatic affections and rheumatoid arthritis, muscular pains, sciatica, local anæsthesia associated with sciatica, &c., remnants of inflammation in the pelvic organs, &c. The continuous uniform pressure on the skin (perhaps best obtained by prolonged mud baths) exercises, according to H. Thiroux, of Saint Amand, a decidedly favourable action in trophic disturbances connected with varicose veins of the lower extremities. The upper part of the thorax should, as a rule, not be immersed, and in diseases of the heart and lungs these baths are contra-indicated, for the weight of the bath press-

ing on the abdomen and lower part of the thorax may give rise to respiratory difficulties. After the bath is over complete rest for a short time is advisable. The action of putty-like mud and fango baths is similar to that of peat baths in many respects, but some mud baths are more fluid. At Piatigorsk, in the Caucasus, and at several places near the shores of the Baltic, as at Hapsal, in Esthonia, and at Arensburg and Pernau, in Livonia (where probably the mud is costly if used in great quantities), baths of *diluted mud* are employed, the action of which doubtless more nearly approaches that of simple water baths at the same temperature than that of semi-solid peat baths.

In Russia the Crimean mud baths have a reputation in muscular rheumatism, chronic articular affections, rheumatoid arthritis, various chronic affections of the pelvic organs in women, scrofulous conditions, and syphilis (generally in association with ordinary antisyphilitic methods). The diet and general regimen of the patients undergoing the treatment are controlled by the physicians.

Local peat baths and mud baths resemble the application of poultices to the diseased or painful part. They are preferable to the general baths in several conditions: in patients with considerable cardiac affection, atheroma, or arterio-sclerosis, and when a tendency to cerebral hæmorrhage is feared; also in very feeble and anæmic patients, and when a part, such as the neck, is affected which cannot well be immersed in the general baths. The 'fango' of Battaglia, Acqui, and other North Italian spas is much employed in the form of local applications, often at very high temperatures (see under Acqui, in Chapter XXV). At Loka and some places in Sweden a sort of massage with mud is employed. The patient sits on a stool and is massaged with the mud by three attendants. At Sandefjord, in Norway, a salt mud from the coast is applied like a hot poultice, or used for rubbing parts of the body, as at Lysekil, in Sweden.

The effect of local or general mud baths must vary much according to *local peculiarities of application*,¹ for instance, the employment of very high temperatures, as in North Italy, the simultaneous use of rubbing or other mechanical means of stimulation, as in Sweden and Norway, or the chemical stimulation of the skin caused by the presence of common salt or 'Mutterlaug' in the mud.

In connection with the action of mud baths, we note that decided radio-activity has been detected in the mud (fango) of Battaglia in Italy, doubtless due to the presence of radio-active minerals. Radio-active substances occur in the deposits from mineral waters, at Bath, Baden-Baden, Nauheim, Wiesbaden,

¹ Cf. Behse, *St. Petersburger med. Wochenschrift*, 1898, No. 10.

Kreuznach, Karlsbad &c., and it is therefore not surprising to find them in 'mineral muds' (compare also the paragraph and footnote on this subject at the end of Chapter XIII). G. A. Blanc,¹ who found radio-activity present in the 'barégine' and hard grey sediment from the 'Alum' spring of Aix-les-Bains, investigated the radio-activity of the sediments from several other thermal springs and mineral waters (Salins-Moutiers, Allevard, Challes &c.) of the alpine region of France, and he concluded that besides traces of radium, some deposits from thermal and mineral springs contain another radio-active constituent, in all probability thorium.

Sand baths.—At some health resorts local or general 'sand baths' are employed; the island of Ischia has been long noted for their use, and they have been introduced at Dresden, at Koestritz, at Lavey (Switzerland), and at some other places. Baths in hot dry sand ('arenation') act doubtless somewhat similarly to local or general hot air baths in chronic neuralgias, rheumatoid arthritis, and stiff joints resulting from former inflammation or injury; they were used a long while ago, but have lately received proper scientific attention. The sand around the affected part is sometimes applied at a higher temperature than that around the rest of the body. At Koestritz the patients in their sand baths are wheeled out into the open air, and thus a kind of 'open-air' treatment is combined with the arenation.

Experiments show that hot sand baths, like ordinary hot water baths, and, according to some observers, hot mud and peat baths, produce an increase in the amount of oxygen taken up and of carbonic acid given off by the body, but the rise of body temperature and subjective effects are less marked in the case of sand baths than in the case of ordinary hot baths.²

INTERNAL USE OF MINERAL WATERS

Internal use of simple thermal waters.—The effect of drinking simple thermal waters much resembles that of drinking an increased amount of ordinary pure water, and the therapeutic use of this has already been discussed in the chapter on Hydrotherapeutics (Chapter XII). It must, however, be remembered that the warmth of these springs makes some difference, for warm water naturally abstracts less heat from the body, and is more easily passed on through the pylorus than cold water; in many persons it increases the action of the bowels less than cold water. Moreover, the extreme softness of some simple thermal waters must be considered, if we remember that the internal use

¹ 'On Radio-activity of Mineral Springs,' *Philosophical Magazine*, January 1905, p. 148.

² See H. Winternitz, *Deut. Arch. f. klin. Med.* 1902, vol. lxxii. pp. 258-290.

of distilled waters has in some cases a slightly different action from that of ordinary moderately hard spring water. We need scarcely repeat again what we have already said in regard to the *possible effects of radio-activity* in certain mineral waters, especially of the simple thermal class, if employed fresh from the spring. Radio-activity, as we have already pointed out, is more likely to play a part in the therapeutic effect of waters employed externally, but nevertheless according to Bergell and Bickel,¹ who experimented with the Wiesbaden Kochbrunnen water before and after the loss of its radio-active emanations, it appears that these radio-active emanations when received into the stomach have the effect of increasing the proteolytic pepsin digestion.² The remarkable action described, however, as being occasionally produced by drinking a single glass of some simple thermal water must be ascribed either to the imagination of an excitable patient or to a temporary reflex effect on the circulation accompanying the mere act of drinking or sipping.³

To the *alkaline silicates* in thermal waters, especially those of the simple thermal group, some therapeutic influence has been ascribed by Alvarenga, Duhourcau, Schlemmer and J. Felix. Felix finds⁴ that solutions of alkaline silicates (one or two parts by weight in a thousand parts of distilled water) have a decided antiseptic action, but are not corrosive, toxic or irritating, like solutions of perchloride of mercury. This antiseptic property of silicate solutions may, he thinks, explain their action in cutaneous affections, vaginal discharges, conjunctivitis, &c. Felix likewise thinks that waters containing alkaline silicates can act as uric acid solvents. According to him,⁵ if a bottle of the water of Sallés-Bains, which contains about 0.13 silicates per mille, be poured into a vessel the walls of which are encrusted with uric acid, the uric acid will in a little time be dissolved, whereas mineral waters containing sodium chloride, such as the water of Châtel-Guyon, will simply detach the uric acid from the side of the vessel and hold it in suspension as if they acted by dissolving a mucous material by which the uric acid was attached.

¹ *Loc. cit.*

² Cf. Bergell and Braunstein, on the influence of radio-activity on proteolytic ferments, *Medizinische Klinik*, 1905, No. 13; also Bergell, *Deut. med. Woch.*, 1905, No. 35.

³ Kronecker found that taking a liquid in numerous small sips temporarily abolishes the inhibitory action of the vagus nerve on the heart. Brunton even suggests that it may be the sipping which gives Karlsbad water part of its effect on the liver, when it is taken at the spa itself, since Rutherford found that sodium sulphate had only a slight stimulating action on the liver; sipping fluids increases the secretion of bile and raises the pressure under which it is secreted. (See Brunton's *Text-book of Pharmacology*, third edition, London, 1887, p. 406.)

⁴ J. Felix, *Gazette des Eaux*, Paris, May 19th, 1898.

⁵ J. Felix, *Annales d'Hydrologie*, Paris, March 1898.

Osmotic action of mineral waters.—It is particularly in regard to the internal employment of mineral waters that the osmotic pressure is of importance. We have already stated in the preceding chapter that according to their osmotic pressure mineral waters may be divided into (1) a hypertonic group, with an osmotic pressure decidedly higher than that of the blood, including the group of purgative bitter waters; (2) an isotonic group, with an osmotic pressure which does not differ very much from that of blood, including many of the best known muriated and sulphated alkaline waters; and (3) a hypotonic group with an osmotic pressure decidedly lower than that of blood, including simple gaseous or 'table' waters, and the relatively 'pure' chalybeate and sulphur waters in which the total amount of salts in solution is a small one. Undoubtedly the purgative sulphated waters, such as Hunyadi Janos and other 'Hungarian bitter waters,' owe much of their therapeutic effect to their hypertonicity. Thus A. Bickel, whose important investigations are referred to in Chapter XX,¹ found that though bitter waters temporarily diminish the specific secretory activity of the mucous membrane of the stomach, they may (doubtless by osmosis) give rise to a watery flow from the gastric walls, so that the fluid contents of the organ are increased.² According to the experiments of von Mering (1893) and others, practically no water and very little salts or food are absorbed from the contents of the stomach, whilst Bickel's and other (including clinical) observations show that hypertonicity of the gastric contents may lead to fluid (relatively deficient in digestive properties) being poured out into the stomach. It has been ascertained that in the stomach hypertonic salt solutions gradually become less hypertonic, and hypotonic solutions become less hypotonic, in fact both classes tend to become more isotonic during their sojourn in the stomach. Thus the motor activity of the stomach which determines the passage onwards of fluid from the stomach into the intestine has much to do with the amount of change which takes place in the osmotic pressure of fluids before they reach the intestine. As to the effect of the internal use of mineral waters on the osmotic pressure of the blood there has been some difference in results. J. Grossmann³ and H. Strauss [contrary to H. Dünschmann (Homburg Elizabethenbrunnen), K. Grube (Neuenahr Sprudel), and F. Engelmann (Kreuznach water)] found practically no change, whilst Szaboky, the most recent observer, concludes

¹ See also the work of H. Strauss and others, referred to in Chapter XIII.

² Compare also the experiments of Esmonet (referred to in Chapter XXII) in regard to the action of very hypertonic sulphated waters (Villacabras water) on the intestinal contents.

³ 'Ueber den Einfluss von Trinkkuren mit Mineralwässern auf den osmotischen Druck des menschlichen Blutes,' *Deut. med. Wochenschrift*, 1903, No. 16, p. 276.

that hypotonic waters tend somewhat to lower the osmotic pressure of the blood (as shown by cryoscopic observations) and hypertonic waters tend to raise it.¹

Carbon dioxide.—Carbonic acid gas (see Chapter XXVII) allays unpleasant sensations in the stomach, increases its secretory and probably in many cases its motor activity also, and thus modifies the effect of muriated and other water. A large quantity, unless got rid of by eructation, may cause unpleasant symptoms either by distension of the stomach² or by absorption into the circulation. It is claimed that carbonic acid gas, as it occurs dissolved in natural gaseous springs, separates much less rapidly and in smaller bubbles, and is more readily absorbed from the stomach than the same gas (proportion and temperature being as far as possible the same) in artificial gaseous waters.

Common salt.—Common salt is a normal constituent of the body. Moderate doses of a watery solution of medium strength stimulate the gastric mucous membrane, and increase its specific secretory activity (see Chapter XVIII), whereas more concentrated solutions diminish the secretion of gastric juice (Hönniger). The increased secretion of common salt by the kidneys favours the solubility of uric acid and facilitates its elimination in the urine. The general nutrition is, if anything, improved by moderate doses, for sodium chloride seems to promote absorption and assimilation of nutritive material, whilst its action in increasing catabolism remains uncertain. In this connection it may be noted that sufficiency of common salt in the tissues helps to keep the various organs well supplied with water and probably facilitates their functional activity. Thus Dr. A. Pugliese, of Bologna, has found that if dogs during starvation are given a certain amount of common salt with their drinking water, they lose less in weight and offer a greater resistance to starvation than dogs who are given simple water without salt (Congress of Physiologists at Turin, 1901). Often, doubtless, as Von Noorden and C. Dapper have shown, much of the effect of courses of muriated waters on the albuminous metabolism and body weight depends on, and can be regulated by, the kind and amount of diet prescribed during the cure. Large doses (above 5 drachms, or even less, daily) may cause gastric irritation in some persons, and very large doses give rise to severe purgation and vomiting. The laxative power of muriated waters differs widely in different individuals, just as the effect of most aperient pharmaceutical preparations does; moderate doses of various muriated waters,

¹ For a consideration of this question and the literature on the subject see J. von Szaboky's paper in the *Berliner klin. Wochenschrift*, 1906, Nos. 24 and 25.

² Notably so if there happen to be gastric ulceration or old peritoneal adhesions about the stomach. For other points regarding the use and abuse of aerated waters see the introductory portion (with footnotes) of Chapter XXVII.

which in some persons have a decided laxative action, in other persons seem to have absolutely no such effect; the effect depends partly also on the temperature at which the waters are taken. The direct action of common salt on the bowel is much increased when given in concentrated solutions, whilst its action on metabolism is greater when taken in a more diluted form.

Sodium carbonate.—Carbonate and bicarbonate of sodium act as anti-acids and allay gastric irritation. The cause of the beneficial effect of alkaline salts in many cases of dyspepsia has been much discussed. It has been generally supposed that moderate doses of these salts or their solutions (simple alkaline mineral waters or artificial solutions) stimulate the secretion of acid gastric juice. Professor J. P. Pawlow¹ from his experiments on dogs has come to the conclusion that alkaline sodium salts exercise rather an inhibitory than a stimulating action on the gastric and pancreatic secretions. To explain their satisfactory clinical effect in many gastric disorders he suggests that they prevent the too prolonged or excessive secretion which often accompanies catarrhal conditions. If this be so, the salts exert a beneficial influence by giving rest to the glandular apparatus during the period when secretion is not required. Adolf Bickel,² by his experiments, to which we shall refer in greater detail in Chapters XVIII and XIX, likewise comes to the conclusion that the simple alkaline group of mineral waters lessen rather than increase the secretory activity of the gastric mucous membrane. Carbonate and bicarbonate of sodium alkalise the blood, and seem often to aid the action of iron in anæmia. They exert a diuretic influence, and probably increase the action of simple water in 'washing out' the blood and tissues. Their effect in bronchial catarrh has been ascribed partly to the solvent action of the carbonate, as it is secreted, on the mucus of the secretion, thus facilitating expectoration.

A possible explanation of the beneficial effects of alkaline salts in many digestive disorders (gouty dyspepsia, irritable hyperacidity, &c.), in tendency to 'biliousness,' and in various so-called 'gouty manifestations,' is that these salts when taken up into the circulation exercise a favourable influence on the metabolic processes generally, thereby improving the general health, and thus indirectly, apart from any special local action, helping to remove conditions of dyspepsia, gouty bronchitis, &c. Such a favourable influence on the metabolism need not merely consist in an alkalising and diuretic action, but may be partly dependent on some kind of stimulation of the glandular cells of the liver³

¹ *Die Arbeit der Verdauungsdrüsen*, German edition, Wiesbaden, 1898, p. 191.

² *Berliner med. Wochenschrift*, January 8, 1906, p. 42.

³ Compare Burney Yeo, 'On Hepatic Inadequacy and its Relation to Irregular Gout,' *Brit. Med. Journ.* June 15, 1901, p. 1457.

and possibly also of other viscera. Such an action on the liver need not necessarily be evidenced by any increased flow of bile, for the excretion of bile cannot be accepted as the index of the total work of all kinds done by the liver. Besides exercising its glycogenic and 'storehouse' functions the liver helps to prevent injurious substances in the portal blood from entering the general circulation, and has certainly a chief share in the manufacture of urea and the end-products of nitrogenous metabolism. Indeed, some have suggested that the bile is little more than a waste product¹ which the liver has to get rid of in exercising its other functions.

Most of the good effects of alkaline salts are obtained by repeated small doses, whilst large doses, at least in some individuals, may cause depression. The effects are of course modified in waters where the alkaline salt occurs associated with common salt (Chapter XX), much carbonic acid gas, or the sulphates of sodium and magnesium, or with both chlorides and sulphates (Tarasp, Karlsbad, &c. See Chapter XXI). Thus, as Adolf Bickel points out, the effect of both carbonic acid gas and common salt in mineral waters is rather to increase than diminish the secretory activity of the stomach, and in his experiments the gaseous muriated alkaline waters (Ems, Selters, &c.) seemed not to exert any depressing action on the gastric secretory functions. On the other hand, as might be supposed from the presence of purgative sulphates, doses of sulphated alkaline waters (Karlsbad, &c.) tended to diminish the specific secretion of the stomach in spite of carbonic acid gas and common salt accompanying the bicarbonate and sulphate of sodium in this group.

Sulphates of sodium and magnesium.—Sulphate of magnesium and sulphate of sodium, when they constitute almost the only active ingredients of springs, impart to them a merely laxative action. This effect is largely due to osmosis, the presence of the salts rendering the contents of the alimentary canal hypertonic to the blood and lymph. In the muriated sulphated and the sulphated alkaline waters the laxative quality of the sulphate is maintained, and doubtless also its depressing effect on the specific secretory activity of the stomach, though the presence of the chloride and carbonate of sodium considerably modifies its action.

Iron.—Iron, when present in sufficient amount, especially in the less irritating form of a bicarbonate, exerts its beneficial action on the quality of the blood in anæmia, especially in simple cases of chlorosis, by increasing the number of red blood corpuscles and, secondarily, the amount of hæmoglobin. This action is often

¹ Brunton (*Brit. Med. Journ.* January 24, 1885) has compared the excretion of bile by the liver to the throwing out of condensed steam by the engines of a steamer.

favoured when the water likewise contains sodium bicarbonate and carbonic acid gas. Though only very little of the total amount of iron which has been swallowed is absorbed from the bowel, some is certainly absorbed, and clinical and experimental¹ evidence seems to show that in simple cases of anæmia the amount absorbed varies chiefly with the quantity and nature of the compound administered. Part of the effect of the portion absorbed on the blood may, as Von Noorden, A. Hofmann, &c.,² suggest, be due to a power of stimulating the hæmatopoietic function of the bone marrow. It appears that courses of gaseous chalybeate waters tend to exert a diuretic influence, and to increase both the proteid anabolism and the proteid catabolism of the body (see first portion of Chapter XXIII).

Manganese salts.—Minute quantities of the salts of manganese occur in some mineral waters. The salts of this metal have been supposed by some to exercise a tonic action similar to that of iron, or to increase the efficacy of iron when given simultaneously with it. By others this action of manganese is altogether denied.³

Arsenic.—Arsenic is present in appreciable quantities in some waters, chiefly of the chalybeate class, and may impart to them some of its beneficial influence in scrofula, in various kinds of malnutrition and anæmia, and possibly in psoriasis and skin affections (see Chapter XXIV).

Iodides and bromides.—Iodides and bromides are present in many muriated waters, including Woodhall Spa, Hall in Upper Austria, Salzburg in Transylvania, the Adelheidsquelle of Heilbrunn, Castrocaro in Italy, Wildeggen in Switzerland, Salies de Béarn, Kreuznach, &c., but hardly in sufficient amount to make it certain that they exercise any therapeutic effect. A. Neisser (Balneolog. Congress, Berlin, 1897) has, however, pointed out that since the minute quantities of iodine compounds present in thyroid extract exercise an undoubtedly potent effect on human metabolism, we must not be too sure of the inertness of the iodine compounds in mineral waters. Moreover, it appears from the experiments of A. Duboin ('Comptes rendus de l'Académie des Sciences,' Paris, 1899, vol. cxxviii. p. 1469) that organic combinations of iodine may be present in some mineral waters.

In some 'Mutterlaugen,' of course, iodides occur in more

¹ Dr. A. B. Macallum, in the *Journal of Physiology*, 1894, vol. xvi. p. 268, showed that inorganic iron compounds are absorbed by the intestinal mucous membrane of guinea-pigs and other animals to an extent which varies with the nature of the compound and the quantity of it given.

² 'Die Rolle des Eisens bei der Blutbildung,' by Dr. A. Hofmann, *Münchener med. Woch.* 1899, No. 29, p. 949.

³ See 'The Causes and Treatment of Chlorosis,' by Dr. Ralph Stockman, *Brit. Med. Journ.* 1895, vol. ii. p. 1475.

considerable amounts; in that of Rothenfelde there is said to be 12·6 per mille bromide of magnesium.

Sulphur.—The action of the sulphuretted hydrogen and minute quantities of the sulphides present in sulphur waters is not easily to be estimated. The effect of the weaker of these waters is probably due to other ingredients they contain, or is that of simple thermal waters. That decided therapeutic effects are obtained from the use of the stronger sulphur waters there can be no doubt. On this subject, however, we must refer to the chapter on sulphur waters (Chapter XXV).

Lithium salts.—It is doubtful whether the lithium salts present in the waters of Baden-Baden, Royat &c. are taken in sufficient amount to produce any special therapeutic effect in gout, &c.

Calcium chloride.—Chloride of calcium, which has been thought to be of use in scrofulous enlargements of glands and other scrofulous affections,¹ in tendency to hæmorrhage or urticaria (with deficient blood-coagulability),² in various kinds of pruritus,³ and in exophthalmic goitre,⁴ has also, since A. E. Wright's⁵ work on its use in hæmorrhages and urticarias, been tried in various other disorders associated with deficient coagulability of the blood. It is present in several muriated waters, and forms the chief part of the salts contained in the 'Mutterlauge' of Kreuznach.⁶

Barium chloride.—In the Llangammarch Wells of Central Wales, nearly 0·1 per mille chloride of barium is present. Barium chloride in very small doses is said to increase the strength of the heart's contraction whilst diminishing its frequency. According to Pesci,⁷ it raises the blood pressure and acts as a diuretic rather by a tonic vaso-constrictor effect on the muscular coats of the small arteries than by direct action, similar to that of digitalis, on the heart muscle itself. The action of barium chloride is therefore more like that of suprarenal extract, and, as Bain and Edgcombe point out, though the rise in blood pressure from barium chloride is not so sharp as that from suprarenal extract, it is more sustained. Barium chloride likewise occurs in several more strongly muriated waters (Kreuznach, &c.), where no soluble sulphates are present to precipitate it. This salt is associated

¹ See 'The Therapeutic Actions of Muriate of Lime,' by J. Warburton Begbie, *Edinburgh Med. Journ.* July 1872, vql. xviii. p. 46.

² See 'On the Treatment of Hæmorrhages and Urticarias which are associated with Deficient Blood Coagulability,' by A. E. Wright, *Lancet*, January 18, 1896.

³ See 'On the Pathology of Itching and its Treatment by Large Doses of Calcium Chloride,' by Thomas D. Savill, *Lancet*, August 1, 1896.

⁴ See Lauder Brunton, in *St. Barth. Hosp. Journal*, 1897, vol. v. p. 37.

⁵ A. E. Wright, *Lancet*, January 18, 1896, *loc. cit.*

⁶ In some 'Mutterlaugen,' such as those of Kissingen and Salzungen, there is less chloride of calcium, but more chloride of magnesium.

⁷ Pesci, *Rif. Med.* November 9, 1904.

with iron in the chloride of iron spring at Harrogate, and with sulphur at the old sulphur well of Harrogate. According to Bain and Edgcombe, the barium chloride counteracts the depressing effect of the other saline ingredients in the latter well, and probably accounts for some of its beneficial properties (see the section on Harrogate in Chapter XXV).

Earthy salts.—In the calcareous and gypsum waters, the carbonate of lime has an anti-acid and soothing effect on the gastric mucous membrane, whilst the sulphate of lime is slightly astringent. This astringent quality need not cause constipation, for, although the intestinal secretion may be lessened, the amount of fluid ingested may be greater, and the peristalsis may remain the same, or even be increased. Usually, however, if not taken in large quantities, earthy waters exert a relatively constipating action, and the diuretic effect of the mere drinking is thus increased, for when less fluid passes off by the bowel, more has to pass off by the kidneys. When taken in very large quantities these waters often have both a diuretic and a laxative effect; to this diuretic effect is probably due some of their repute in cases of urinary gravel, &c. Here we may likewise allude to a possible influence of calcareous salts on the metabolism and their effect in some cases of reducing the secretion of uric acid in the urine (Kionka, Noorden &c., see Chapter XXVI). It is very doubtful if the lime in these waters has any special action on the nutrition of the bones, though according to Rumpf when much lime is ingested with the food, some of it remains stored up in the body and may increase the tendency to the deposition of calcareous matter in diseases of the cardio-vascular system in old persons. It is possible that the internal employment of calcareous waters, owing to the calcium salts which they contain, might be useful in some cases of chronic and recurrent urticaria, chronic headache &c. which are associated with deficient coagulability of the blood.¹

Nitrogen, argon, and helium.—Nitrogen, and since its recent discovery in mineral waters, argon, have been generally supposed to be therapeutically inert, but various writers, including A. Robin, E. Duhourcau, and W. H. Robertson (Buxton), have maintained

¹ See A. E. Wright, 'On the Treatment of Hæmorrhages and Urticarias which are associated with Deficient Blood Coagulability,' *Lancet*, January 18, 1896, and 'On the Association of Serous Hæmorrhages with Conditions of Defective Blood Coagulability,' *Lancet*, September 19, 1896; A. E. Wright and W. E. Paramore 'On Certain Points in Connection with the Exaltation and Reduction of Blood Coagulability by Therapeutic Measures,' *Lancet*, October 14, 1905; W. E. Paramore, 'An Experimental Study of Some Cases of Urticaria,' *Brit. Journ. of Dermatology*, 1906, Nos. 7, 8; G. W. Ross 'On the Relief of Certain Headaches by the Administration of one of the Salts of Calcium,' *Lancet*, January 20, 1906. In this connection it may be noted that several mineral waters besides those of the earthy class contain considerable amounts of calcareous salts; for instance, the Rakoczy spring at Kissingen contains one gramme of calcium carbonate to the litre.

that the nitrogen in thermal waters may be an active agent. On theoretical grounds one must not hastily conclude that these gases when dissolved in mineral waters are altogether indifferent substances, though in most cases they appear to be so. Further observations are, however, necessary before it can be settled that they exert any definite action. In this connection Dr. A. Labat has pointed out that some of the published analyses of springs give a much greater proportion of nitrogen than any water can possibly contain. The presence of helium in a mineral water, as helium is now acknowledged to be a derivative from radium emanation, points to radio-active properties being present in the spring in question.

Inhalation of mineral waters : pulverisation methods.—Besides being taken by the mouth, the waters of some spas, especially those containing chloride and carbonate of sodium and sulphur, are inhaled for affections of the respiratory system, in order, if possible, to obtain the local action of the mineral water on the affected mucous membrane. When the pharynx or the nasopharynx is the part affected, a coarse spray may be inhaled, so also when it is desired only that the spray should reach the upper part of the larynx. In cases, however, of chronic bronchitis, when it is desired that the spray should reach the mucous membrane of the bronchial tubes without exciting cough, it is necessary, especially when there is laryngeal irritability, to have the mineral water exceedingly finely pulverised. This is best effected by one of the methods which fill the entire room with the pulverised water, the patients being able to sit comfortably and inhale the spray which pervades the atmosphere about them. The modern treatment of affections of the respiratory system by 'pulverisation' methods was initiated by Sales Girons, at Pierrefonds, 1856-1858.

In the employment of hypotonic mineral waters for local sprays, douches, and gargles in the treatment of nasal and pharyngeal affections, irritation of the mucous membrane (in sensitive patients) can be avoided by adding a little common salt to the mineral water so as to make it isotonic with human blood (Depierris with Cauterets waters, Heitz with Royat waters, and Pelon¹ with Luchon waters). Similarly, hypertonic muriated mineral waters and sea water can be diluted to make them isotonic.

Gradirhäuser.—Another method of inhalation is that of sitting close to 'Gradirhäuser,' structures which were originally used merely for the manufacture of common salt from salt springs. The Gradirhäuser at Kreuznach, Kissingen, Reichenhall, Salzingen &c. are enormous fences of twigs, down which the salt water is made to trickle from top to bottom. There are walks and seats arranged for the patients at the

¹ Quoted by Lucien-Graux, *Application de la Cryoscopie à l'Étude des Eaux Minérales*, Paris, 1905, pp. 197-202.

sides of some of these structures, and patients usually sit on the side away from the wind. Doubtless, in addition to watery vapour, particles of the salt water itself, in the form of a fine spray, are inhaled. A brine fountain in the neighbourhood, such as is present in the Kurgarten of Reichenhall, will increase the amount of salt water spray present in the air. The effect of the ozone produced by these arrangements may likewise be taken into account.

Inhalation of gases.—The gases given off from mineral waters, especially sulphuretted hydrogen, nitrogen, and carbonic acid, are sometimes inhaled together with ordinary air and with spray and watery vapour from the mineral water, but it is very doubtful if any real therapeutic use has been obtained from inhalation of the gases in question. A kind of 'Gradirhäuser' on a small scale is employed for the inhalation of nitrogen from the waters of Lipp Springs. In some 'natural vapour baths,' such as the 'Stufe di San Germano,' near Naples, the vapour contains an admixture of sulphuretted hydrogen.

Other factors in spa-treatment.—So far we have discussed the physical effect of baths and the pharmacodynamic action of mineral waters when taken internally. These effects of the mineral waters might often be obtained by their judicious employment at home, or even, to some extent, by the employment of artificial mineral waters, but treatment at spas depends for its success also on other factors, and it is our intention in the following chapter to take into consideration the mental repose or change in mental occupation, the change in climate, surroundings, mode of life and diet, accompanying spa-treatment.

Exported (bottled) natural mineral waters.—These can of course be employed at the patient's home, but various factors on which the success of spa-treatment sometimes in part depends are missing in the home-treatment. Moreover, natural mineral waters often undergo a change on being kept, even after careful bottling. This is especially the case in regard to chalybeate and sulphur waters, and we shall again refer to this subject in the introductory portions of Chapters XIII and XV. Lucien-Graux by his cryoscopic researches has found that the osmotic pressure of some mineral waters also undergoes a change on keeping; thus, the freezing point of the waters of Contrexéville, Vittel and Martigny is decidedly less depressed in the case of the bottled waters obtained in Paris than in the waters obtained at the places themselves fresh from the springs. In regard to the action of some mineral waters the loss of radio-active properties in the kept waters may likewise be considered.

Natural mineral waters 'medicated' for special purposes.—For therapeutic purposes two mineral waters may be mixed together before use, as, for instance, the Kur-Brunnen and the Ludwigs-Brunnen at Nauheim; or an ingredient may be got rid of, as, for example, the sulphides from the Old Sulphur Well of Harrogate; or salts may be added to a natural mineral water, as sodium bicarbonate to the Kochbrunnen of Wiesbaden to make 'Wiesbaden Gichtwasser.' Similarly, from the Josephsquelle and Leopoldsquelle of Rippoldsau by the addition of sodium carbonate and carbonic acid gas 'Natrine' and 'Schwefelnatrine' are respectively prepared. So, also, by salts added before bottling 'Pitheathly cum lithia,' 'Johannis potash water,' and 'Johannis lithia water' are produced. The 'Cheltenham Natural Aperient Water' is prepared by artificial concentration from the Chadnor Villa Well at Cheltenham, and what is known as 'Kissingen Bitterwasser' is obtained from brine springs by a method of Liebig. Sometimes iron is removed before bottling in order to make a mineral water 'keep' better, as in the case of the exported water of the Lullusbrunnen of Hersfeld; in other cases

a mineral water may be artificially impregnated with carbonic acid gas to keep the iron in solution. 'Sulis' table water is prepared from the thermal water of Bath by the addition of carbonic acid gas, which hinders precipitation. To make an agreeable table water out of the Kaisерquelle at Aachen the water is freed from its sulphur and artificially aerated before bottling.

Artificial mineral waters.—The manufacture of artificial mineral waters seems to have commenced with the artificial aëration of ordinary water. According to W. Kirkby's interesting article in the 'Pharmaceutical Journal' (June 4, 1898, p. 526) it appears that Dr. Brownrigg, of Whitehaven, about the year 1743, ascertained that the peculiar prickly taste of the waters of Pyrmont and of Spa was due to the presence of carbonic acid gas, or 'fixed air' as it was formerly called.

The artificial impregnation of water with this 'fixed air' was carried out in the eighteenth century by Joseph Priestley, Nooth, Thomas Henry (of Manchester), and others. It is, however, to Professor F. A. A. Struve that the careful imitation of different natural mineral waters is due. Their serious employment for internal medical use was introduced by him in 1820–21 at Dresden, and in 1825 he founded the 'German Spa' at Brighton, which originally had a pump room kept open in the morning to enable visitors to drink the imitation waters of celebrated foreign spas, just as they would do at the spas themselves. The 'German Spa' is now simply a factory for the making of artificial mineral waters. Struve's book, 'Ueber Nachbildung der natürlichen Heilquellen' (Dresden, 1824–6), remains one of the best works on the subject. O. Ewich, however, and since him others, carried the process still further, and employed artificial mineral waters, not exactly identical with any natural ones, but having their constituents specially adapted to suit certain classes of patients. This subject has once again been discussed by W. Jaworski in an article, 'Ueber rationelle Zusammensetzung und therapeutische Verwendung der Mineralheilwässer' (Berlin, 1902). Artificial mineral waters, except seltzer and other table waters, are at present very little employed in England. The salts, however, contained in some mineral waters, whether actually extracted from the waters in question or chemically similar to those extracted, are more or less in general use. They are often dissolved in water and employed (Karlsbad, Marienbad, Brides-les-Bains, Salschitz) as occasional purgatives or as the natural mineral waters; or else (Vichy, Bilin, Ems, Soden-in-Taunus, Marienbad &c.) they are employed in the form of pastilles (generally containing sugar). It may here be mentioned that the osmotic pressure (as indicated by the freezing point) of artificial mineral waters is stated by no means always to be the same as that of the natural mineral waters (especially when fresh from the source) which they are intended to imitate.

Some mineral waters are likewise *imitated for external use*. Thus the various natural brine baths can be effectually imitated by dissolving the proper amount of common salt in ordinary water, with or without the addition of some exported 'Mutterlauge.' Natural sulphur and muriated sulphur baths have also been imitated. In recent times gaseous effervescent baths have been artificially produced (systems of Lippert, Mack, Kiefer-Fischer, Keller, Sandow, Guaglio), which, with a certain amount of success, imitate the Thermal-Soolbäder of Nauheim and the gaseous 'iron baths' of chalybeate spas (cf. artificial 'Schwalbach baths' at Harrogate). It has even been proposed by E. Neusser, of Vienna (1905), and others to imitate the radio-activity of some thermal waters by the help of minerals containing uranium, radium or other radio-active 'elements,' so as to produce 'artificial Gastein baths.'

CHAPTER XV

THE INFLUENCE OF CHANGE OF AIR AND DIET AND HABITS IN THEIR CONNECTION WITH SPA-TREATMENT—ORDINARY MEDICAL AND SURGICAL TREATMENT AT SPAS—ACCESSORY SPA-TREATMENT—MUSCULAR EXERCISES AND MASSAGE IN CONNECTION WITH SPA-TREATMENT

It is always very hard in estimating the effects of spa-treatment to separate that which is due to the mineral waters from that which is due to change of air, diet, mode of life, and mental occupation. If these latter did not contribute largely to the good results obtained, and if the results were merely due to the internal and external use of spa waters, it would be possible in most cases to carry out the treatment at home with the aid of imported or even artificial mineral waters. As a matter of fact the home treatment often fails, or its result falls far short of that obtained at the spas themselves. Nor is this to be wondered at when we consider the effects of 'change of air,' and of some other advantages (to which we shall refer in the present chapter) which treatment at the spa itself often has over the employment of the mineral water at the patient's home.

Change of air.—Every reader has probably experienced some of the effects attributed to 'change of air.' It would be quite unnecessary to describe, if that were possible, what all feel when from the confined air of rooms or offices in some large smoky town they go for their holiday and inspire the fresh fragrant country air, or the invigorating sea or mountain breeze.

Sun baths, light baths, air baths.—During a holiday much time is fortunately usually spent in the open air; sunlight, including the invisible 'chemical' rays, which probably penetrate more deeply than ordinary light rays, plays some part in the good effect, probably increasing the general nutrition of the body, as well as rendering the air more aseptic. The maximum effects of sunlight and pure air are obtained at some places, such as Veldes, where during the warm weather the patients, practically

undressed or very lightly clad, take actual 'sun baths'¹ or 'air baths.' The use of 'open air,' 'pure air,' and general climatic treatment in pulmonary tuberculosis, one of the greatest scourges of humanity, is fortunately already widely known. This subject and 'sun baths' are mentioned here to illustrate how much influence climate and change of air must obviously have in ordinary spa-treatment; it is not only in tuberculosis that judicious 'open-air treatment' can be of service; pure air should play a great part in the treatment of most diseases, especially in those chronic forms, from which patients endeavour to obtain relief at spas and health resorts. We shall return to this subject in Chapter XXXI in regard to the selection of health resorts. (See also the Section on Light in Part I, Chapter I.)

Climate, altitude, situation, and surroundings of spas.—The elevation of some spas above the sea-level gives them a real mountain climate. St. Moritz, in the Upper Engadine, is about 6,000 feet above the sea; Panticosa, in Spain, Loèche-les-Bains, in Switzerland, Bormio, in Italy, and Barèges, in France, are situated at elevations of 4,000 to 5,500 feet. Mont-Dore and Caunterets, in France, Gastein, in Austria, and Tarasp, in Switzerland, have altitudes of between 3,000 and 4,000 feet. Many other baths lie at considerable elevations. Buxton, in Derbyshire, has an elevation of 1,000 feet, and its relatively high and open position imparts a delightful freshness to the air. The upper portion of Llandrindod, in Wales, though it has only the very moderate elevation of about 700 feet, owing to its open situation on a kind of moorland, has a climate equally bracing to that of many higher localities on the Continent. In regard to questions of climatotherapy, however, we must refer to what we have said on the various places mentioned in Part I.

The situation and surroundings of a spa are important in other ways than in determining the amount of shelter from wind, insolation, and warmth. It is important that there should be beautiful scenery in the neighbourhood, and that there should be suitable roads and paths in different directions, many of them on nearly level ground, but others so arranged as to necessitate a certain amount of gentle climbing exercise. There should be an abundance of woods or avenues where patients may rest or walk protected from the heat of the sun. The slopes surrounding many of the Continental spas, especially the German ones, are richly wooded; the forests are carefully kept, and, in some cases, form part of the property of the spa, and are devoted to the use

¹ The warmth and light of sun baths have been, to some extent, as previously mentioned, imitated artificially by the employment of electric light or 'radiant heat' baths.

and enjoyment of the visitors. Certainly in the acquisition and maintenance of neighbouring shady walks, or of planting them out, if they are not there already, several English and French spas would do well to follow the example of some of their fortunate rivals.

In selecting a spa the season when the patient requires treatment must be considered, a spa being selected at which the climate during that part of the year is at its best in regard to the case in question. (Cf. the section in Chapter XVI on 'Seasons for Spa-Treatment.')

Psychical influences in spa-treatment.—The good effects of taking an ordinary holiday, usually attributed to 'change of air,' are doubtless often in part psychical, and due to change in mental occupation. The dull routine of office work, the excitement and worries of commercial enterprise or professional life, and the ceaseless round of dinner parties and society engagements, are alike laid aside. The mind is occupied in other ways. To many country life has something of the charm of novelty; to others it recalls pleasant recollections and re-awakens earlier interests. Rest, quiet, and soothing scenery are usually most keenly relished by those whose brains have been hardest worked, and are often of great importance to patients of excitable temperament; whereas to others accustomed to a quiet or 'dull' life, gaiety and 'recreation,' such as are often found at frequented Continental resorts during the season, are attractive, and probably often beneficial.

If such psychical action is needed on ordinary holidays, it is still more important during spa-treatment. A course of powerfully acting mineral waters, though occasionally it may do good, cannot be recommended in most cases whilst the patient has to attend to a worrying business or social fatigues. Sometimes the only way to keep a patient away from business cares is to insist on his going to a health resort at some distance,¹ or else for a long sea voyage.

There should, however, be no *ennui* at spas, and this is often well guarded against at foreign spas, where bands and concerts in the open air are provided and social entertainments looked to. Patients at spas should be made as cheerful as possible, and their thoughts should be diverted from their ailments by healthy mental influences. Neglect of this factor in spa-treatment has

¹ The journey, however, must not be made too fatiguing by continuous 'through' travelling. If the health resort be distant, the journey should be interrupted by rests of a day or more at suitable localities; by not observing this point patients are likely to arrive at their destination in a state of fatigue which renders a considerable period of rest advisable before commencing spa-treatment. See also the Section on 'Journey to the Health Resort' in Chapter XXXI.

led to want of success at some spas, whilst the due recognition of its importance has contributed largely to the success of other spas. In the treatment of chronic diseases the mind can and should be used as a most powerful agent. Change of occupation and amusement act as psychical tonics or alteratives; they doubtless promote the nutrition of nerve-cells in the cerebral cortex, and through improved nutrition of the brain cause improvement of nutrition and function in distant organs.

In many persons, especially those with gouty and rheumatic tendencies, and whose occupation demands much brain work or favours sedentary habits, a condition of general fatigue and nervous exhaustion is likely sooner or later to occur, so that a holiday becomes absolutely necessary. How much of this 'break-down' is due primarily to mental overwork, and how much to the accumulation of waste products in the system from insufficient exercise or too liberal diet, varies doubtless in different cases. The management of such conditions (which might often have been prevented by attention to regimen and taking a holiday in time) consists in mental rest or change of occupation on account of the nervous condition, with appropriate treatment (some form of muscular exercise with intervals of physical repose in the open air, diet, mineral waters, hydrotherapy) for the disordered state of the general metabolism. When spa-treatment is adopted in such cases, a sufficient total period of holiday must be secured by insisting on an 'after-cure' at some suitable climatic station (see Chapter XXVIII).

Regulation of diet and mode of life.—Another advantage of treatment at a spa over treatment at home is a certain amount of routine in the treatment, not to be regarded as a thoughtless, 'mechanical' method of treating all patients. A patient finds it easier to change his diet and habits when others are doing the same thing; it becomes, indeed, almost necessary to do so. Moreover, a regular active life in the open air undoubtedly often lessens an inclination to abuse of stimulants, not only alcohol, but also tea, coffee, and too stimulating foods. Thus, over-indulgence in food (and perhaps alcohol), hurried meals at irregular times, and late hours, give place to early rising, regulated diet, regular meal-times, and going to bed early. Regulation of the diet is particularly difficult to effect at home, and what a large part this plays in the treatment of obesity and glycosuria at Marienbad, Karlsbad &c. is generally acknowledged (see Chapters XVI, XXI and XXIX). These considerations help to illustrate the advantages which treatment at the spa itself often has over treatment by a mineral water at home. We need not again allude to the influence of mental rest or 'recreation' or change of occupation

(cf. the section on 'Rest and Recreation' in Chapter XXIX), nor to the value of a more open air mode of life (cf. the section on 'Opportunities for Open Air Treatment' in Chapter XXXI). To the advantages of muscular exercises in many cases and the facilities provided for various forms of active and passive exercises at spas we shall refer further on in the present chapter.

Ordinary medicinal treatment at spas.—As a general rule, ordinary pharmaceutical treatment is employed as little as possible at spas, patients rightly or wrongly thinking they have had enough of drug-treatment before they are sent to spas, or having a special dislike to medicines.

In certain cases, however, it may be a question whether the good results obtained by spa-treatment are due not so much to the waters as to ordinary pharmaceutical treatment used simultaneously. For the latter supposition there is doubtless ground. Thus the reputation of Aachen (Aix-la-Chapelle) and some other German and French spas in syphilis has been due, in great part, to the ordinary antisiphilitic methods employed, and to the attention paid to the subject by the local doctors; the reputation of Karlsbad in diabetes is partly due to similar causes, and so is that of Oeynhausen (Germany) and Lamalou (France) in chronic organic nervous diseases. Certain spas owe some of their reputation in gynæcological affections to the skilful local treatment employed by the doctors, and Wildungen is famous for the surgical treatment of urinary diseases.

Accessory spa-treatment.—In other cases the reputation of the spa is due not so much to the water as to the employment of energetic hydrotherapeutic measures (see Chapter XII), special exercises, massage, electricity, &c.—in fact, to the employment of what may be grouped together under the term 'accessory spa-treatment.' This is the case, to some extent, at Aix-les-Bains for joint affections, and to similar causes Nauheim owes much of its recent celebrity in heart affections. We have already alluded to 'accessory treatment' by hot air and vapour baths, electric light ('radiant heat') baths, and hydro-electric methods.

Milk cures, Grape cures &c. at spas.—The use of milk, whey, koumiss and kephir, as well as of 'grape cures' and other 'fruit cures,' will be referred to in Part III, Chapter XXIX.

Massage and active and passive exercises in connection with spa-treatment.—Massage is occasionally employed in most spas. Local massage (with or without general massage) is used in the treatment of stiff joints, chronic stages of sciatica, lumbago, neuralgias, various forms of gouty or rheumatic neuritis (chronic stages), painful fibrous ('rheumatic') indurations in the fasciæ

and muscles (the 'fibrositis' cases of Gowers), and multiple painful subcutaneous fatty nodules; also in some kinds of headache, habitual constipation, passive congestion (from cardiac and other causes) of the abdominal viscera, some cases of dyspepsia, and some chronic catarrhal conditions and states of disordered function of the abdominal viscera. After injuries to bones and soft parts massage promotes the absorption of inflammatory and reparative products, including callus. General massage is useful in the treatment of patients for whom much voluntary muscular exercise is temporarily or permanently unsuitable or impossible. It requires no will-power on the part of the patient and is very valuable in some neurasthenic cases (Weir-Mitchell treatment). In all such cases it to some extent supplies the place of voluntary exercise, and aids the digestive functions and promotes nutrition of the tissues, not leanness. Hand massage can often be replaced by machine massage; and there exist now a great number of machines (Zander's and others) for applying various kinds of massage or vibratory massage to different parts of the body.

At some spas, as at Aix-les-Bains, Vichy, and Uriage, massage is much employed simultaneously with or under the weight of the thermal douche; at other spas the thermal douche is applied so forcibly as to produce a kind of massage effect (Bourbonnelles-Bains). Joints are often massaged in hot baths, or under hot douches, or after being subjected to local hot air or steam baths. A relaxation and an anodyne effect are sought for by the help of such a preparatory heating or 'steaming' of the affected part.

Swedish gymnastics, mechanotherapy, and Nauheim exercises.—Institutions for 'mechanotherapy' have been established at many foreign spas, furnished with Dr. G. Zander's and similarly constructed medico-mechanical appliances for passive movements and for voluntary muscular exercises with graduated resistance. Institutions of this kind are to be found at Aix-la-Chapelle, Wiesbaden, Baden-Baden, Wildbad, Karlsbad, Marienbad, Ragatz, Aix-les-Bains, Vichy, &c. Here graduated movements of all kinds may be prescribed in order to exercise particular joints and particular sets of muscles.

Swedish gymnastics without these special mechanical appliances, according to the original system of P. H. Ling, are practised under strict medical superintendence at Homburg, Baden-Baden, and other localities, including several French spas. In the 'Schott' treatment for heart affections at Nauheim, a form of 'Widerstands-Gymnastik' (movements with resistance) is carried out under the direct superintendence of the doctor or skilled attendant. In the systems of Ling and Schott the amount of the resistance is determined by the hand of the superintendent,

whereas in Zander's system it can be graduated by altering the weights and levers of his machines.¹

Graduated walking, climbing, and cycling exercise compared to 'resistance-exercises' and massage.—Graduated voluntary exercise, in the form of the 'Terrain-Cur,' was several years ago largely introduced into practice, especially at German and Austrian health resorts, such as Reichenhall, Baden-Baden, Meran, &c. Besides numerous level promenades, a variety of sloping paths were made on the surrounding hills and slopes, which involve different, but graduated, amounts of up and down 'climbing' exercise to those who go along them. Maps of all such walks at some health resorts were constructed, for the use of both doctors and patients, and in selecting a series of walks for his patient, the doctor can regulate the time, the length, and the amount of climbing exercise for every day's morning or afternoon walk. In suitable districts graduated cycling exercise may often, if preferred, replace part of the walking, at all events in the less serious class of cases; indeed, in some cases of stiffness in the joints the former method of exercise may be found the more useful of the two. The arrangements for the 'Terrain-Cur,' as it is termed, were introduced after the writings of Professor M. J. Oertel, of Munich, in 1886, had directed attention to his method of treating chronic heart affections by gradual climbing exercise ('Ueber Terrain-Curorte zur Behandlung von Kreislauf-Störungen,' Leipzig, 1886). The use of exercise in certain heart affections had already been advocated by Stokes, who, writing on the treatment of 'incipient fatty diseases of the heart' (Professor William Stokes, 'Diseases of the Heart and the Aorta,' Dublin, 1854, p. 357), commences thus: 'We must train the patient gradually but steadily to the giving up of all luxurious habits. He must adopt early hours, and pursue a system of graduated muscular exercise, &c.'

Considerable rise of blood pressure doubtless occurs both in health and disease at the commencement of any form of active

¹ Some of the machines introduced by Zander, Herz, and others are used for active or passive movements, others for various kinds of massage. Martin Siegfried (*Deutsch. med. Wochenschrift*, 1897, No. 27) has specially drawn attention to the therapeutic use of the tricycle in various affections as an instrument for graduated active and passive movements of the lower extremities. For this purpose he employs a tricycle the treadles of which can be adjusted to revolve in a small or large circuit as required. For passive movements the tricycle may be pushed or dragged by assistants, the patient's feet merely resting on the pedals. A support for the patient's back is required in some cases. Siegfried occasionally makes use of an arrangement, by which the upper extremities may replace or aid the lower extremities in driving the machine. See also Siegfried's paper on *The Applicability of Certain Forms of Apparatus in the Mechanico-Balneological Treatment (Nauheim Treatment) of Heart Disease*, English translation, London, 1903.

exercise, whether mild or violent, if the task is sufficient to tax the energy of the individual who undertakes it. This rise of blood pressure corresponds to the period before the 'second wind' is obtained, and is associated with subjective feelings of strain and discomfort even in healthy persons when 'out of training.' Afterwards, when the 'second wind' reaction is obtained, the peripheral resistance to the blood-flow is diminished. G. Oliver finds that any kind of exercise leads to vaso-dilatation, and has shown that the resulting increase in the volume of the limbs can be measured. It has even been suggested that during exercise some substance is manufactured in the muscles which has the same effect as vaso-dilator drugs have when they enter the blood stream. Lauder Brunton and Tunnicliffe by their experiments recorded in the 'Brit. Med. Journal' (October 16, 1897) have shown that even gentle exercise is followed by a dilatation of the muscular arterioles, with an increased flow of blood through them. Oertel found that a rise in general blood pressure invariably followed muscular exercise. Brunton and Tunnicliffe, however, believe that in Oertel's experiments the amount of exercise was sufficient to cause considerable strain and to quicken the respiration. They find that with exercise so gentle as to cause no hurry in the respiration and no increased frequency of the pulse, the blood pressure during the exercise itself first rises above the normal, but begins to fall, even during the continuance of the exercise, and continues to fall so that at the end of the exercise it has generally come down to the normal. After the cessation of the exercise they find that the blood pressure still further falls, and may remain sub-normal for half an hour or longer, after which time it gradually rises again to its initial height. Brunton's opinion ('Harveian Oration,' 1894) is therefore confirmed, namely that carefully regulated resistance-exercises, such as those practised by Schott at Nauheim, occupy a therapeutic position between the 'Terrain-Cur' of Oertel and massage with the patient resting. In massage the primary rise of blood pressure is least of all, though the subsequent fall is not so great and not of so long duration as after voluntary exercises. Massage has therefore the preference when the heart is so feeble that the primary rise of blood pressure caused by even the most gentle voluntary exercise is to be feared (see further on in the present chapter).

Uses of exercise and massage.—To the value of muscular exercise in headache associated with habitual constipation &c. we shall refer again in Part III. Its great usefulness in many cases, by furthering the oxidation and elimination of waste products and toxic materials circulating in the blood, is undoubted, and

can hardly be over-estimated. By regular exercise much may be done to prevent the premature degeneration of the tissues, those of the vascular system in particular, to which persons with an inherited arthritic tendency are specially predisposed. By judicious exercise the voluntary muscles are enabled to make use of the sugar circulating in the blood in some minor glycosuric cases. On the action of regular exercise as an aid to dietetic treatment in hindering excessive development of fat in the body, we need not enter here. Swimming is a form of exercise a certain amount of which is often suitable in convalescents and others, especially in young persons who enjoy it. Many spas and summer health resorts are provided with good swimming baths (fresh water or brine) or offer facilities for open air bathing in rivers, lakes or the sea.

A moderate amount of muscular exercise in those who are able to take it, helps the body to get rid of waste products, and promotes the healthy nutrition of all the tissues. When, owing to debility, neurasthenia, obesity, stiff joints, or certain affections of the circulatory and respiratory systems, sufficient ordinary muscular exercise, such as walking, has become impracticable, massage can often be practised with advantage, and, as we have already stated, it requires no will-power on the part of the patient, whilst it favours the digestive functions and helps to maintain the nutrition of the tissues. In regard, however, to the promotion of oxidation in the body, according to Hans Leber and Strüve,¹ metabolism is apparently only very slightly increased by massage in comparison to what it is by active exercise.

It is probable that courses of the various active and passive exercises, and of hydrotherapeutic treatment, all help to get rid of the toxic materials and waste products which have accumulated in the body. This is effected either by oxidation within the body, or by elimination in the urinary and other excretions. H. Forestier ('Med. Press and Circular,' April 8, 1891) has found that in gouty patients the excretion of both urea and uric acid in the urine is increased, when they undergo the 'douche-massage' treatment (see under Aix-les-Bains), and that towards the end of a course of treatment the quantity of urea and uric acid in the urine commences to fall to the normal.² A. Ranglaret ('Annales

¹ Experiments carried out with the assistance of C. von Noorden at Frankfurt. See 'Ueber den Einfluss der Muskel- und Bauch-Massage auf den respiratorischen Gaswechsel,' *Berliner klin. Wochenschrift*, 1896, No. 16.

² In this connection it may be noted that E. Pfeiffer (*Berl. klin. Woch.* 1896, p. 248) thinks that thermal baths may be useful in deciding whether uncertain pains and joint troubles are gouty or not. According to him, after about twenty thermal baths, such as those of Wiesbaden, the daily amount of uric acid excreted in the urine is sometimes very much diminished (by its half or more), and in such cases he thinks the diagnosis of the uric acid diathesis can be made, and the symptoms be considered

d'Hydrologie,' Paris, November 1896, p. 491) has not only confirmed these conclusions of Forestier, but, as far as his limited number of experiments go, has proved by injections into rabbits that the specific toxicity¹ of the patient's urine is increased during the first part of a course of 'douche-massage.'

Massage and exercises in affections of the heart and circulatory system.—Lauder Brunton and Tunnicliffe have shown ('Journal of Physiology,' December 1894) that massage causes a diminution of peripheral resistance in the vessels of the kneaded muscles, and that hence, soon after the kneading, an increased flow of blood through the part takes place, together with a fall of the general blood pressure. During the massage the blood pressure may be slightly increased; but this slight increase does not throw so much extra work on the heart as occurs at the commencement of voluntary exercise, even when gentle and carefully graduated resistance-exercises are the kind employed. Hence, in cases where the coronary arteries of the heart are diseased, and any attempt at climbing exercise causes attacks of angina pectoris, massage may be employed as a substitute for voluntary exercise without inducing such attacks. In other cardiac cases, where for various reasons the patient can take only a very limited amount of voluntary exercise, this deficient amount may be supplemented by massage.

When only very little voluntary exercise is possible, it is sometimes best that it be taken under skilled supervision. In the use of Dr. Zander's machines this supervision is supplied by the medical attendant, who prescribes the exercises or who is present in the room whilst they are performed; in the systems of Ling and Schott the supervision is supplied by the doctor or skilled attendant, who furnishes the resistance to the movements.

Respiratory exercises in disorders of the circulation, &c.—Brunton ('Lancet,' October 12, 1895) has given a reason why

gouty. The same phenomenon, he thinks, cannot be observed when some other cause is at the root of the trouble.

¹ It is not improbable, as has been suggested, that the group of symptoms, known as 'well-fever,' often appearing during spa-treatment, is partly due to a temporary excess in the toxic materials circulating in the blood previously to their elimination. If this supposition be correct, 'well-fever' may be regarded as analogous to the pains and stiffness felt at the commencement of a walking tour, or after any unusual muscular exercise in persons who are 'out of training.' [Exercise in persons out of training perhaps gives rise to the familiar pains and stiffness, firstly by inducing a too sudden catabolism in the muscles, secondly by bringing into the circulation waste products which were previously stored up in the tissues.] Bearing also in mind the analogy between the temporary pains and stiffness resulting from unwonted muscular exercise, and those often complained of by gouty, rheumatic, and anæmic persons, it is not astonishing that such patients should often complain of an increase in their pains shortly after commencing spa-treatment.

voluntary muscular exercise, in some cardiac cases, has an advantage over general massage. During exercise the respiratory movements are increased, and thereby a kind of indirect massage is practised on the heart¹ and large thoracic vessels; the return of venous blood being doubtless especially aided. This is one reason for assuring, where possible, a certain amount of voluntary exercise, or of special respiratory movements, even when massage serves the main purpose. Swedish gymnastics often best supply this exercise, because in these forms the amount can be easily regulated and the movements varied as required. In fact, by varying the movements and the amount of resistance to the movements, the exercises can be so carefully 'dosed out' that the initial rise of blood pressure need not be feared; it is in the treatment of chronic affections of the heart and circulation that the 'Resistance-Exercises' ('Widerstands-Gymnastik') have been especially employed. (See Chapter XVIII, under Nauheim.) We have in this chapter already referred to the probability that oxidation in the tissues is furthered more by a little voluntary exercise than by a considerable amount of massage.

The effect of the increased respiratory movements which accompany voluntary muscular exercise is not limited to the thoracic organs. H. Barnard ('Lancet,' 1899, vol. i. p. 1080) explains how the contraction of the abdominal muscles, accompanying the descent of the diaphragm and enlargement of the thorax during inspiration, favours the passage of blood from the abdominal veins to the right side of the heart and lungs, the following expiration helping to move the blood on from the lungs and left side of the heart into the arteries. An abdominal massage-like effect is produced by forced inspiratory movements which may be carried out in the form of regular 'respiratory exercises.' At regular intervals, after a deep inspiration, the breath may be held for some seconds before letting it out again; in this method the liver and other abdominal viscera are effectually but gently squeezed by the inspiratory contraction of the abdominal muscles, and their circulation is promoted. In fact, P. J. Moebius ('Münchener med. Wochenschr.' 1899, No. 10, p. 313) has recommended inspiratory exercises as a kind of 'massage of the liver' in some hepatic disorders.

¹ G. Heinrichs and H. Kronecker drew attention to this massage action of respiratory movements on the heart in their 'Beiträge z. Kenntniss d. Einflusses der Respirationsbewegungen auf den Blutlauf im Aortensysteme' (*Abhandlungen d. math.-phys. Classe der Königl. Sächs. Gesellschaft der Wissenschaften*, 1888, vol. xiv. p. 427). Dr. G. Hamel notes the similar massage action exerted by the pulse of arteries on the surrounding tissues ('Die Bedeutung des Pulses für den Blutstrom,' *Zeitsch. f. Biologie* 1889, vol. xxv. p. 474).

Frenkel's method of systematic exercises for incoordination of movement in tabes dorsalis is employed at certain health resorts—see Chapter XXXIX.

Importance of the local medical men.—What has been said in the present chapter serves surely to emphasise the fact that the knowledge, capability, and energy of the local medical men contribute largely to the success of spa-treatment, and this factor must always be taken into consideration when selecting a spa for patients. We shall return to this subject in Chapter XVI.

Specialisation of spas.—Paracelsus believed in a specific action of different mineral waters in special diseases. Partly from tradition, partly on well-established balneotherapeutic grounds, but in great measure also, as has just been explained, owing to the knowledge and exertion of the local doctors, many spas have obtained a widely spread popular repute in the treatment of particular affections. By the observations and special studies of local doctors, and of doctors who send patients to the spas, the indications for certain spas have gradually become more sharply defined. This 'specialisation of spas' is most noticeable in France, where the writers on the subject, with the characteristic liking of the French for order and classification, seek to define more and more clearly what the exact class of cases is that each spa is particularly suited for. It may perhaps be questioned whether the theoretical grounds on which these exact limitations are founded are yet sufficiently established for building any very elaborate scheme. The resources of most spas can be greatly varied to suit different kinds of cases. However, the tendency to specialise spas and other health resorts more definitely is on the whole likely to lead in the right direction, and is in many cases convenient for all concerned—a kind of division of labour, in fact.

CHAPTER XVI

DAILY LIFE AT SPAS—DURATION OF THE CURE—NECESSITY FOR MEDICAL SUPERVISION—DIET AT SPAS—SEASONS FOR THE CURE—IMPORTANCE OF AN 'AFTER-CURE'

A FEW words may be said of the daily life of patients whilst treated at foreign spas. This must naturally vary according to the strength of the patient, his previous habits, the nature of his ailment, and the kind of spa-treatment he is undergoing; it must necessarily be largely regulated by the spa doctor, and depends somewhat on local customs of the particular spa. A certain amount of routine is, however, often useful, for patients find it easier to follow rules when others about them are doing the same. Doubtless rules for drinking the waters, bathing, and regulation of diet, had formerly become too stereotyped at some spas, and were followed too rigidly without sufficient regard to the special condition of individual patients (see under Karlsbad). Such local rules, which in former times were arbitrarily imposed on all persons drinking the same kind of mineral water, have in recent times been wisely modified or relaxed to suit the requirements of different constitutions.

Daily life at spas.—At most German and foreign spas the patient's day begins early. He gets up at six or seven (or even earlier), drinks his water gradually, chatting and promenading, whilst a band, to the expenses of which the visitors subscribe, enlivens the Curplatz. Breakfast consists of coffee or tea and rolls, to which, especially in the case of English patients, a couple of eggs or a little ham, chicken &c. are often added. This can be taken at a suitable time after finishing the prescribed amount of mineral water; the usual time will be between seven and nine, according to the hour when the patient has started his day. There should if possible be an interval of three-quarters to one hour between finishing the prescribed dose of mineral water and the morning meal. But, though it is the rule to take the waters on an empty stomach, in the case of delicate patients a cup of milk or tea or coffee can be allowed on rising; in some cases the waters may be drunk in the patient's room. Rarely it is found preferable to delay taking them until before the midday or

evening meal. In decided atonic conditions of the stomach the patient should, as Ageron points out, lie down, not walk about, when, or immediately after, drinking the waters.

In Germany the middle meal of the day is at about one o'clock; in France it is earlier. Concerning the daily life at a French spa, see the description of Cauterets in Chapter XXV. Baths at health resorts may be taken in the morning early, after drinking the waters, or, if there is not time then, before the midday meal. Needless to say, they should not be taken shortly after a meal, at which time much blood is needed in the internal organs for digestive purposes. When the spa is overcrowded and the bathing accommodation not great, the time for the bath must depend on priority, and this at some spas may, during the height of the season, cause the patient great inconvenience and even harm. Open-air concerts, promenades, and occasionally pleasant excursions into the surrounding country, help to fill up mornings and afternoons until the evening meal at five, six, or seven. Sometimes drinking the water a second time before the midday or evening meal is ordered; occasionally, especially when it is advisable that the patient should drink very little at a time, or when an unusually large daily amount is required, the water is taken three times in the day. Chalybeate waters are sometimes taken after meals or with the meals, and if a large amount of free carbonic acid gas disguises the taste of iron, they form pleasant table drinks.

Duration of the cure.—There is no fixed time for the 'cure' to last. Three to four weeks is probably about the average, but spa-treatment, like any other treatment, must vary according to the patient's condition and the ailment. It is absurd to think that in every chronic disorder all the good which can be done by spa-treatment can be done in twenty-one days. The time can sometimes only be settled by the medical man who is watching the progress of the case, and in many cases of chronic disease it is necessary to continue the course over six or eight weeks, or to have two courses in the same year separated by an interval of one or two months.

Importance of medical supervision at spas.—Medical supervision is absolutely necessary. The progress of the case must be watched. The patient requires advice on many points, as to diet, as to the nature and amount of exercise, and the time of day at which to take it, as to when to drink the waters, and how much to take, as to temporary omission of baths or other spa-treatment on the appearance of eruptions or 'well-fever' (see further on in this chapter), or during menstrual periods, or during intercurrent illness from chills, mistakes in diet, &c. Sometimes the doctor orders that the waters, if cold, be warmed; or, if too strong, be

diluted with ordinary drinking water or milk or whey; or that their taste be improved by the addition of some gaseous water, &c. Some patients, unless they are under supervision, overdo the treatment in regard to drinking the water. Too much exercise is sometimes taken, a danger especially to be guarded against in the case of chlorotic girls and anæmic persons. Many patients cannot be satisfactorily treated unless they have very precise rules to follow, and this exactness can only be furnished by a doctor at the spa itself. On his guidance the result of the treatment often depends, and he should receive from the medical attendant at home an account of the patient's condition and previous treatment. By his successful general management of cases the good reputation of a spa is often largely increased.

Careless use of mineral waters.—Although very large quantities of mineral waters have sometimes been drunk with impunity or apparent benefit, even the 'indifferent' waters should not be taken without caution and supervision. Very serious symptoms, and even death by syncope or apoplexy, have been known to follow the sudden drinking of cold water or excessive quantities of hot water. •

'*Well-fever.*'—A lesser evil of drinking too large quantities is the disturbance of the system known as 'well-fever,' 'Bad-Friesel,' 'fièvre thermale,' 'crise thermale,' or 'poussée thermale;' it may also be produced by excess of bathing or other external use of the mineral water, and consists in febrile uneasy sensations, and sometimes dyspepsia, lassitude, diarrhœa, and skin eruptions. These symptoms, which were formerly supposed to be of a critical and beneficial nature, ordinarily pass off with, at the most, a temporary cessation of the treatment or the administration of a sedative drug. At Loèche-les-Bains (Leukerbad)¹ the eruption or 'poussée' is considered still a normal accompaniment of the treatment by prolonged tepid baths, and A. Grimaud² maintains that a 'crise thermale' is both useful and necessary at Barèges. Well-fever may perhaps in some cases be compared to the pain and stiffness often felt even by healthy persons at the commencement of a walking tour. But the cause need not always be the same, and Dresch³ explains the symptoms 'as the result of an auto-intoxication, more or less combined with an infection by the bacillus coli.'

Diet.—The rules as to diet during the cure at some spas were formerly too strict and stereotyped; the same 'cure-diet' was observed no matter what the patient suffered from, the 'Sprudel-

¹ De la Harpe, *La Suisse Balnéaire*, 1895, p. 113.

² *Annales d'Hydrologie*, Paris, April 1897, p. 170.

³ *La Fièvre Thermale*, Paris, 1897, p. 9.

Suppe' supper of Karlsbad (see Chapter XXI) being a favourite example of this severe dieting.¹ Articles such as butter and tea were, without sufficient reason, prohibited in all cases. Doubtless such general rules suited many individuals, especially in regard to limitation of the evening meal, which is most desirable when patients have to go to bed early, and rise betimes to drink the water in the morning. Another custom formerly prevailing (or still in favour) at some spas must have been useful in many cases, namely, that of supplying the place of the morning coffee or tea by a 'Mehlsuppe,' or by a kind of oatmeal porridge, by barley or rye or rice soup, or by a broth made with milk or eggs.

The very strict rules of 'cure-diet,' formerly observed by all patients at some spas, have indeed been wisely relaxed. It is, however, most important that the spa physician should be able to supervise the patient's diet, as he can, to a certain extent at least, at Karlsbad. *Table d'hôte* dinners in this respect are somewhat inconvenient, and the *à la carte* system of many German and Austrian spas is on the whole preferable to the special diet tables advocated by some authorities. Many now maintain that the only diet to be observed during a course of mineral waters is that suitable to the patient's constitution and disease, and should be quite irrespective of the kind of mineral water taken. In all probability, however, some persons have to be specially careful in their diet, and have to confine themselves to a 'blander' diet than usual, in order to escape gastro-intestinal derangements, when they are taking saline, especially purgative saline, waters, which irritate the digestive mucous membrane.²

Seasons for spa-treatment.—The season for spa-treatment is necessarily limited to the time during which the spa is open. This is mostly from May till October, although some, especially French spas, do not really open, or even profess to, before June. Bath, in England, is open all the year round, and some foreign spas, such as Aix-la-Chapelle, Amélie-les-Bains, Dax, Acqui, Baden-Baden, and Wiesbaden, are likewise open throughout the year. Amongst more distant thermal resorts available during the winter months are Termini-Imerese in Sicily, Helouan in Egypt, and Hammam R'Ihra in Algeria; the latter is specially frequented in spring and autumn (November). St. Moritz, in Switzerland, is kept open as a climatic resort in winter, though its baths are closed. At some spas the baths are kept open the whole year

¹ According to F. A. Hoffmann, potatoes were once forbidden at Kreuznach, because the iodine of the water might combine with the starch in the potatoes!

² Cf. Curt Pariser, 'Die Homburger Diäten—Ein Beitrag zur Frage kurgemässer Diät in Badeorten,' *Berliner klin. Wochenschrift*, 1906, No. 23, p. 775. Vandeweyer and Wybauw think that little fat should be allowed during treatment by chalybeate waters (see Chapter XXIII).

round, though the most reliable doctors are only available during the main season. In the colder climates the summer months are convenient for a cure, because the patient can remain the greater part of the day in the open air; moreover, on account of the warmth of the air, less heat production and tissue metabolism are required, and therefore a better opportunity for the alterative and depletive action of mineral waters is afforded. If a winter course be adopted, the patient should, if possible, have his lodging in the building in which his bath is, so as to render him independent of inclement weather; such an arrangement is possible at Bath, Aix-la-Chapelle, Wiesbaden, &c. For those who bear heat badly, it is advisable to avoid the hottest summer months at Aix-les-Bains, Aix-la-Chapelle, Ems, Baden-Baden, Wiesbaden, Neuenahr, Ragatz, and other hot localities.

Preparatory treatment.—At one time preparatory treatment of a severe nature was advised before taking a course of waters. This was according to the antiphlogistic theories of the time. Preparatory treatment is still sometimes adopted, such as rest at some climatic health resort, dietetic or special medicinal treatment, but not the excessive purging &c. of olden days. Sometimes a course of water at one spa serves as preparatory treatment to a course at another. Thus in certain conditions a course of muriated, muriated alkaline, or muriated sulphur waters may be useful before a course of chalybeate waters; so also a spa of moderate elevation may be recommended before one of high elevation; for instance, a course of chalybeate waters at Spa or Schwalbach may precede a course at St. Moritz.

Use of the water after leaving the spa.—Sometimes, on discontinuing a laxative course at spas, such as Karlsbad or Marienbad, there may be troublesome constipation. This may require the continued use of the mineral waters, or their salts, for some time after leaving the spa.

Importance of an 'after-cure.'—Generally speaking, an 'after-cure' (German, 'Nachkur') is of the greatest importance, especially after the more active waters, such as Karlsbad, Marienbad, and Kissingen. Instead of going immediately to their homes and beginning their usual mode of life again, patients should abstain from active work and keep to a simple diet and open-air life for some weeks. They may go to some pretty part of the country not far removed from the spa, or to some not very distant mountain health resort. For some time subsequent to courses of active laxative waters, the nervous system and bodily functions are in a specially sensitive condition, and are easily thrown out of order (as they are during convalescence from an infectious disease) by nervous excitement, business worry, or bodily fatigue.*

During the 'cure'¹ the patient gets rid of the unhealthy and effete material accumulated in his tissues. During the 'after-cure' a vigorous building-up process ought to take place, just as it does during convalescence from a disease, and new healthy material is assimilated by the tissues in place of the unhealthy material cast off during the 'cure.' Roughly speaking, something of this sort is what takes place, and neglect of the 'after-cure' may lead to disagreeable consequences, another break-down, and the patient may lose all the good results of the treatment. In many cases of 'brain-fag,' with or without actual 'break-down,' the three weeks or so occupied by the spa-treatment, even if we were to regard them as a period of rest (or change of occupation) for the mind, would not be as long a holiday as the condition of the patient's nervous system requires. In such cases an after-cure has to be prescribed, for the simple reason that the patient must be kept away from his work for a longer period than that of the spa-treatment. At some spas the importance of the 'after-cure' seems still to be hardly sufficiently recognised.

In a subsequent chapter (Chapter XXVIII) we shall give a short summary of suitable localities for the 'after-cure' in different classes of patients.

¹ The word 'cure,' when equivalent to the German 'Cur,' or 'Kur,' as in 'mineral water cure,' 'climatic cure,' 'rest cure,' 'milk cure,' &c., is used throughout this book as signifying a course of treatment.

CHAPTER XVII

SIMPLE THERMAL WATERS

THESE waters taken internally (cf. Chapter XIV) help in the removal of waste products from the tissues, and hence are useful in some cases of chronic gout and rheumatism, and in preventing affections connected with auto-intoxication, especially in those cases where more active waters are not advisable. By increasing the secretions and rendering the contents of the bowel more fluid, they may be of service in cases of constipation due to insufficient intestinal and biliary secretion. By their soothing local action, and by their indirect influence on the general nutrition, they may have a good effect in some forms of gastralgia and irritable conditions of the gastric and intestinal mucous membranes.

In the form of warm baths they exercise a sedative influence on the nervous system. Hence they may be useful in some cases of neuralgia, in hyperæsthesia, painful menstruation, nervous cough, and tendency to hysteria and functional nervous affections, especially in individuals of the erethic class.

Many of the warm baths of this group have been employed for the chronic results of localised peritonitis, even after operations, and particularly for the remnants of inflammation in the pelvic organs (chronic perimetritis, parametritis, peri-parametritis). At Plombières the baths have been made use of for treating the chronic troubles left after perityphlitis (appendicitis).

As baths, these waters have also enjoyed a great reputation in the treatment of painful cicatrices (especially the hotter baths), and in the healing of troublesome wounds and chronic and callous ulcers.¹ In the latter class of cases they act doubtless, partly by improving the general health of the body, partly by a local action, similar to that of the local and general baths employed by surgeons in phlegmons, burns, &c. They clear away discharges from the surface of the wound, maintain an even temperature, promote and equalise the circulation in the skin, and in the case of very

¹ Thus Paracelsus, in his account of Pfæfers (a genuine work of his), speaks of the curative action of these waters in cases of ulcers, sinuses, and incompletely healed wounds. In the Apothecaries' Hall of London is a painting of the baths of Pfæfers, and it may be presumed that Franc. Manning, British Minister to Graubünden, whose attempted assassination, June 27, 1711, is recorded on the picture, considered that he owed a debt to these waters.

chronic, callous ulcers, probably produce a beneficial reaction (see further on). In these days of antiseptic and aseptic surgery this class of spa-treatment is of course less required.

The action of prolonged tepid baths as employed at Loècheles-Bains in chronic psoriasis and cutaneous eruptions is probably somewhat similar. The tepid water macerates the epidermic scales of psoriasis, and washes away the scales and exudation of eczema; the capillary circulation is favoured and after some days a more or less striking cutaneous 'reaction' or 'poussée' is produced, the subsidence of which should be followed by great improvement or cure (though perhaps only temporary) of the cutaneous affection. This method of treatment, like other methods exciting an inflammatory reaction or exacerbation, is only suitable in chronic and inactive cases. Some of the successful cutaneous cases of former days may have been in persons afflicted with scabies, before the '*acarus scabiei*' or '*sarcoptes hominis*' had been discovered as the cause of the affection. In such cases the parasites may simply have been drowned in the long-continued baths. Owing to the germicidal action of sulphuretted hydrogen, thermal sulphur baths (see the commencement of Chapter XXV) were doubtless still more successfully employed than simple thermal baths in such cases and in various other parasitic skin affections, as well as in the treatment of old wounds and chronic ulcers.

It seems difficult to understand how any permanent benefit can be derived from warm baths in organic affections of the nervous system; nevertheless, some simple thermal springs, such as those of Wildbad and Gastein, have obtained a reputation in the treatment of chronic spinal affections. It is certainly unlikely that warm baths judiciously used can do harm in commencing cases, and by improving the general nutrition they may do at least temporary good in chronic affections of the spinal cord, they may relieve the pains of *tabes dorsalis*, and possibly at times arrest the progress of a chronic case; the possibility, however, of a spontaneous arrest must always be kept in mind. It is probable that in former times thermal baths sometimes got the credit of curing cases of paralysis which were really of functional nature, and cases of paraplegia and apparent *tabes* when these were really due to peripheral neuritis,¹ and in the ordinary course of events would have tended to recovery.

Much is now known of the ætiology of multiple peripheral

¹ Some cases of peripheral neuritis, the so-called '*pseudo-tabetic*' cases, may, as is well known, imitate the ataxic gait of true *tabes dorsalis*. It is possible that the recovery of this form of cases under simple thermal treatment may have helped in giving some spas a reputation of being able to cure incipient cases of *tabes dorsalis*.

neuritis (polyneuritis), and most cases can be traced to alcoholic drinks, lead, arsenic, and the toxins circulating in the blood after diphtheria, enteric fever, and other infectious diseases; but in other cases the cause cannot exactly be ascertained, and they are still spoken of as idiopathic. In chronic stages of multiple peripheral neuritis simple thermal spas may be of use, but they are still more likely to be serviceable in the (generally unilateral) so-called 'gouty' and 'rheumatic' forms of neuritis, formerly classed as sciatica, brachialgia, and various local neuralgias. In these cases of 'sciatica' &c. the thermal spa-treatment is likely to be useful when, though the acute symptoms have passed off, there remains a certain amount of pain, anæsthesia, paræsthesia, muscular wasting, or slight loss of motor power. In such cases, as also in lumbago and all the various forms of what Sir W. R. Gowers regards as 'fibrositis,' spa-treatment at thermal springs may, accompanied by massage in the chronic stages, often do good by exerting a favourable influence on the general nutrition and on the excretions, as well as by the local thermal action and the massage.

It has been suggested by H. Scoutetten,¹ and many others, that the therapeutic effects of simple thermal and other baths might be in great measure due to electrical action between the body and the water of the bath. It is not, however, probable that any electrical currents, which may be set up between the body and the surrounding thermal water, exercise any special therapeutic action. Neither is it a satisfactory suggestion that these waters owe their power to the nitrogen or the alkaline silicates which they contain, though, according to J. Felix, solutions of alkaline silicates seem to possess a certain antiseptic action and are likewise to be regarded as uric acid solvents (see the paragraph on silicates in Chapter XIV). On the other hand, it may turn out that radio-activity has something to do with the special effects attributed to certain waters of the simple thermal class, such as Gastein and Plombières,² when fresh from the spring-head. Apparently some of the least mineralised springs show the most radio-activity.

¹ H. Scoutetten, *De l'Electricité considérée comme Cause Principale de l'Action des Eaux Minérales sur l'Organisme*, Paris, 1864.

² See P. Curie and A. Laborde, 'Sur la Radioactivité des Gaz qui se dégagent de l'Eau des Sources Thermales,' *Comptes Rendus de l'Académie des Sciences*, May 9, 1904, and E. Hamaide, 'De la Radioactivité des Eaux de Plombières,' *Presse Médicale*, Paris, May 28, 1904. See also F. Bernard (of Plombières), 'De l'Etat Actuel de nos Connaissances sur les Phénomènes attribuables à l'Action Radiothérapeutique des Eaux Minérales,' a paper read at the Congress on Hydrology, Venice, October 1905. See also L. Wick, 'Ueber die Beziehungen der Radiumemanation in der Gasteiner Therme zu deren Heilkraft,' *Berliner klin. Wochenschrift*, 1906, Nos. 15 and 17; and H. Sieveking, 'Die Radioaktivität der Mineralquellen,' *Berliner klin. Wochenschrift*, 1906, Nos. 23 and 24. See also the references on this subject given in Chapters XIII and XIV.

Mineral waters of other classes are more frequently employed internally for gout, but in many delicate gouty persons no mineral waters need be drunk, the treatment being limited to tepid baths aided by climate and diet.

In chronic rheumatism, painful rheumatoid arthritis, sciatica, and neuralgias the hotter baths are more useful than the tepid ones. In chronic cases of muscular rheumatism, sciatica, and in stiff joints from gout, chronic rheumatism, or rheumatoid arthritis, douches, massage, and Swedish gymnastics form often the most important part of the treatment, altogether superseding, in some cases, the simple hot baths.

In selecting a spa of this group much must depend on the ability in the local medical guidance and on the skill of the persons applying the douches, massage, and Swedish gymnastics. In other cases the accommodation, accessibility, situation, climate, and elevation above the sea-level, must be considered in addition to the temperature of the waters. In the following pages the situation, altitude, temperature of the waters &c. of most spas belonging to this group will be found.

Wildbad and Ragatz-Pfäfers have been placed first to serve as types, and the other resorts have been arranged in the political geographical order adopted for all the classes of spas, viz.: Great Britain, Belgium and Holland, Germany and Austria-Hungary, Switzerland, France, Italy, Spain, Portugal, Russia, and North Africa. Bath, Buxton, Gastein, Schlungenbad, and Plombières might equally well have been given as types of this class of spas.

Wildbad (Württemberg) lies at an altitude of 1,410 feet in the deep valley of the Enz, a typical valley of the Black Forest, with lofty rather steep pine-clad slopes on both sides, up which long zigzag walks may be taken. The main direction of the valley is from north upwards to the south; the climate is fairly bracing, and even in hot weather the nights are rather cool.

Wildbad, in spite of the great number of visitors who resort to it during the season, has not become too large, and has fairly well preserved its reputation as the type of 'Wildbäder,' or simple thermal baths.¹ The temperature of the springs varies from 91·5° to 104·5° F. The Eberhards-Brunnen and the Königs-Brunnen are the most used for drinking, but there is naturally little difference between the different springs. Karlsbad or similar salts are added when a laxative effect is required, and, when desirable, the waters of other spas are drunk at Wildbad.

¹ Wildbad in Württemberg must of course not be confused with other less-known so-called Wildbads in Germany (Wildbad-Burgbernheim, in Bavaria, with weak sulphated earthy waters, existed as early as the twelfth century), nor with the famous Wildbad-Gastein in Salzburg, described further on in this chapter. In regard to the significance of the term 'Wildbad,' see Chapter XIII.

The chief reputation of Wildbad depends on its baths. There are two excellent bath-houses, the Great Bath-house and König Karls Bad, which both belong to the Württemberg Government. The kind of bath chiefly used is the 'Wild-Bad,' an ordinary thermal bath in which the water bubbles up from a sandy floor, and is kept continually running off by the overflow pipe, so as to imitate a bath at an idyllic thermal fountain. There are likewise ordinary thermal baths, cold water baths (for which the cooled thermal water is used), hot air and vapour baths, electric baths, douches, and a set of Dr. Zander's medico-mechanical appliances for 'Swedish gymnastics.' Poor patients can have cheaper baths in the Katharinen-Stift. In the bath the surface of the body becomes covered with small bubbles, probably of nitrogen, but this phenomenon is not supposed to have any therapeutic significance.

The indications for Wildbad are those of simple thermal springs in general, namely, rheumatoid arthritis and gouty affections in feeble subjects, stiff joints from these affections or from the results of injury, convalescence from acute and chronic diseases, irritable functional nervous affections, nervous dyspepsia, some gynecological affections and chronic skin eruptions. Cases of commencing chronic organic nervous affections, amongst which may be classed paralysis agitans, though its anatomical pathology is not yet known, likewise resort to Wildbad, as to other mild thermal waters, and are said sometimes to derive temporary benefit from their visit. In those exhausted from overwork or town life the pure healthy mountain air and the necessary alteration in their mode of life doubtless play a chief part in the results obtained. For those who cannot, or care not to, walk uphill there are walks along the valley in both directions. The season lasts from May 1 to the end of September.

Ragatz-Pfäfers (Switzerland, Canton Saint-Gall). The baths of Ragatz and Pfäfers in Canton St. Gall are both supplied by the thermal waters of Pfäfers, the first medical account of which was written in 1535 by the famous Swiss physician, Paracelsus, and dedicated by him to Johann Russinger, the liberal-minded Abbot of Pfäfers.

Ragatz, at an altitude of about 1,700 feet, is a station on the railway from Sargans to Chur. It is situated on the south-western side of the valley on both banks of the Tamina, where this stream issues from a narrow defile to join the Rhine. The surroundings are very beautiful, and give scope for a variety of excursions. A funicular railway from Ragatz takes one up to the ruins of Wartenstein (with hotel accommodation), about 1,000 feet above the town, overlooking the valley.

A walk of about three miles (in a south-westerly direction) up

the romantic Tamina Gorge brings one to the thermal spring and bath-house of Pfäfers, which has an elevation of about 400 feet above Ragatz.

The waters of Pfäfers are simple thermal (total solids, 0.29 per mille), and it may be mentioned that they, like the waters of Wildbad, are especially rich in nitrogen gas. Their temperature at the source is 98.6° F.; in the bath-house of Pfäfers, 93.5° F.; and in the wooden pipes by which the water is conducted to the baths of Ragatz, the temperature falls to 89°-93° F.

The patients who make use of the baths at Pfäfers lodge in the bath-house. The present building, which was commenced by the monks of Pfäfers in 1704, is naturally somewhat old-fashioned, and its position in the deep gorge is rather too confined and sunless. It is used chiefly by Swiss families, most persons preferring to live and take their baths at the modern spa of Ragatz.¹ In Ragatz there are four excellently arranged bath-houses for the ordinary thermal baths, and a swimming bath supplied with thermal water. There are likewise arrangements for douches and electric baths, and complete apparatus for hydrotherapy. An institution fitted out with Zander's medico-mechanical appliances for 'Swedish gymnastics' is of use in suitable cases.

As at other 'Wildbäder,' the waters in many cases are used for drinking as well as for baths. In former times patients used to remain for many hours at a time in the bath, and even had their meals brought to them there; but the average duration of a bath is now about half an hour; and in the same way, although very large doses of the water were formerly used internally, now only three to six glasses daily are recommended.

The indications for Ragatz are of course much the same as for other spas similar in climatic situation and in the nature of their waters. One may mention rheumatoid arthritis, chronic rheumatism, sciatica, the 'uric acid diathesis,' many digestive and functional nervous disorders in the delicate and more irritable classes of patients. In chronic non-tuberculous articular affections, in sciatica and neuralgias, the judicious use of massage and Swedish gymnastics is often added. Like most thermal baths, these baths are employed in various chronic 'gynæcological' affections and in chronic cutaneous eruptions. In cases of slow convalescence from acute diseases, the climate, the music, and the cheerful spa life are of great assistance. Early chronic cases

¹ Yet, should radio-activity prove to have anything to do with the therapeutic action of the old baths of Pfäfers, it ought to be noted that the waters when they reach Ragatz, three miles distant, will have lost some of their power. Thus, it has been shown that when the radio-active waters of Gastein reach Hof-Gastein, five miles distant, they have already lost most of their radio-active property.

of various organic diseases of the nervous system are said often to derive at least temporary benefit from treatment at Ragatz.

The season at Ragatz lasts from the beginning of May to the end of October; that of Bad-Pfäfers from June to the middle of September. The best time for Ragatz is from the middle of May to the end of June, and from the second week in August to the second week in September. The accommodation is excellent.

Bath (England, Somersetshire).—The waters of Bath, the 'Aquæ Solis' or 'Aquæ Sulis' of the Romans, are the only really hot natural waters of Great Britain. Their temperature is 104° to 120° F., and (King's Well, Attfield's analysis) they contain 1·3 per mille sulphate of calcium, 0·3 per mille of sulphate of sodium, 0·2 per mille each of chloride of magnesium and common salt, and about 0·1 per mille of carbonate of calcium and sulphate of potassium (total solids 2·4 per mille). Very extensive remains of the Roman thermæ exist, and are carefully preserved. They are connected with the modern thermal establishment, which was extended in 1897. The city is beautifully situated on the Avon, eleven miles to the west of Bristol, and owing to the surrounding hills the climate is mild and equable, so that the waters can be used all the year round. Spring and autumn are, however, the favourite seasons for a 'cure.' The surrounding 'downs' attain a height of 550 to 800 feet above sea-level; Lansdown, to the north, reaches 800 feet. Much of the city itself is built in terraces on the hillsides, so that the houses are at various elevations, 100 to 600 feet above sea-level.

Owing to a variety of causes, and partly merely to 'change of fashion,' Bath has lost much of the fame which it acquired in the eighteenth century: a fame in great part due to Beau Nash, and the fashionable guests whom the amusements, organised by him, attracted. Of late years, however, all kinds of hydrotherapeutic appliances, and treatment by douches and massage, have been introduced, similar to those employed at foreign spas. There are likewise facilities for radiant heat baths (electric light baths) and various forms of electrical treatment. Such 'accessory' methods are essential to the efficiency of a simple thermal spa, and probably increase the number of visitors to Bath.

'Douche-massage' is given by specially trained attendants either after the manner of Aix-les-Bains or as practised at Vichy. The 'Nauheim treatment' for cardiac affections has likewise been introduced at Bath (see under Nauheim in Chapter XVIII). There are inhalation and spray rooms for affections of the pharynx and respiratory organs.

The waters are used internally as well as externally, their internal action being, doubtless, similar to that of the simple thermal waters generally. It is not likely that the minute quantities of

iron and arsenic contained in the water exert any therapeutical action, and hardly more likely that the nitrogen and recently discovered argon have any special effect. Still, it must be remembered that the waters contain radium emanation and helium,¹ and, as we have already pointed out, some of the therapeutic action of simple thermal waters may possibly be due to radio-activity.

The hot baths of Bath are useful in chronic gout, rheumatoid arthritis, and some cases of sciatica and neuralgic and muscular pains. When the patient's joints are stiff, he can be lowered into a bath on a crane-chair. Berthollet local vapour baths and electric light baths are also employed in a similar class of cases. In psoriasis and chronic cutaneous affections the baths may exert a good effect on the skin. In the results of lead poisoning, in functional nervous troubles, in painful menstruation, thermal and hydrotherapeutic measures may be employed. Bath may be termed the winter resort of England for the spa-treatment of muscular rheumatism and the various conditions of pain and stiffness which Gowers has grouped together under the heading 'fibrositis.'

There is a 'Mineral Water Hospital' at Bath to enable poor persons to undergo the spa-treatment. A military sanatorium for rheumatic and gouty complaints, or for the effects of wounds and accidents, might be erected here, as at Teplitz, in Bohemia, Barèges, and Bourbonne, in France, &c. Bath, owing to its position, has the great advantage of being open for invalids all the year round. There is now excellent hotel accommodation at Bath.

The table water sold in bottles as 'Sulis Water' is the natural Bath water artificially aerated with carbonic acid gas.

Buxton (England, Derbyshire).—The waters of Buxton (temperature 82° F.) must be classed with those of Bath; but they are not so hot, and the climate of Buxton is more bracing than that of Bath. The situation of Buxton (in a broad shallow depression, at a mean altitude of 1,000 feet), and its position in the beautiful and interesting Derbyshire Peak District, attract a crowd of visitors as well as invalids to the spa. It was several times visited by Mary Queen of Scots.

The Buxton waters are still more weakly mineralised than the Bath waters, and contain (St. Anne's Well), according to J. C. Thresh, only 0.2 per mille of bicarbonate of calcium, and about 0.1 of bicarbonate of magnesium (total solids 0.4). They are rich in nitrogen, and argon forms about 2 per cent. of the total amount of gas. Radium emanation was recently detected in the

¹ In regard to radium at the Bath springs, see R. J. Strutt, *Proc. Roy. Soc. London*, 1904, vol. 73, p. 191; and in regard to the production of helium from radium see Sir W. Ramsay and F. Soddy, *ibid.* vol. 72, p. 204, and vol. 73, p. 346.

water by Lord Blythswood and H. S. Allen. Besides the simple thermal waters, there are weak non-gaseous chalybeate waters. For internal use the thermal waters are given in doses of from four ounces to half a pint.

The baths are employed at the natural tepid temperature of the water for four to seven minutes; or, as in the case of weaker persons, in whom the power of reaction is unsatisfactory, they may be given artificially heated to a temperature of 86°–100° F. The duration of the hot baths usually is from three to fifteen minutes. Crane-chairs are used for lowering crippled patients into the baths. Douches are much employed in conjunction with the baths, and when there is much tenderness they are given under the water of the bath. After the tepid baths, a walk to favour the reaction is often advised.

Temporary slight disagreeable effects are sometimes observed during a course of bathing here as at other spas. The treatment can naturally be varied considerably to suit individual cases, and should always be carried out under the guidance of a local medical man.

Chronic gouty and rheumatic affections, rheumatoid arthritis, and the stiffness in the joints resulting from them, are especially treated at Buxton. In the various conditions of weakness, produced by prolonged attacks of gout and rheumatism, Buxton is often eminently useful, partly, no doubt, through the influence of its bracing climate. Other conditions, yielding to simple thermal waters, hydrotherapy, and a tonic climate, may likewise be benefited here.

There are facilities at Buxton for massage, ordinary hydrotherapeutic procedures, Nauheim baths and exercises, the Aix douche-massage, hot vapour, hot air, and electric light ('radiant heat') baths, local mud baths of 'fango' exported from Montegrotto in Italy, various methods of electrical (including D'Arsonval high frequency current) and hydro-electrical treatment (see Chapter XII, section on 'Hydro-electrotherapy'), &c.¹ Syphilis can be treated according to the Aachen methods.

The season is from April to September, but Buxton is open all the year round. The Devonshire Hospital at Buxton supplies thermal and climatic treatment to the poorer classes.

Matlock Bath (England, Derbyshire).—Matlock Bath (temperature of the water 68° F.) is situated in a beautiful valley in Derbyshire on the left bank of the Derwent, but too much in a hollow for the climate to be bracing. The waters, which, according to Dr. Dupré, contain about 0.2 per mille carbonate of calcium

¹ For a concise account of the various methods of treatment, see W. Armstrong and J. E. Harburn, *Buxton: its Waters, Baths, and Accessory Methods of Treatment*, Bristol, 1903.

and 0·1 per mille sulphate of magnesium, are chiefly used for bathing. Some hydrotherapeutic establishments in the neighbourhood, such as the one founded by Smedley (altitude 450 feet), are in higher, more open, and more bracing positions than Matlock Bath itself (altitude about 300 feet). Lumbago, sciatica, gouty and rheumatic joint affections can be treated. Pleasant excursions may be made to various localities of the Peak District, and in Matlock itself and its immediate neighbourhood the 'petrifying wells' and the various 'caverns' are objects of interest. Amongst the various thermal methods of treatment to be obtained at Matlock are local mud baths of 'fango' exported from Battaglia in Italy.

Bakewell (altitude about 400 feet), likewise in the Peak district, has similar waters (temperature 60° F.) and an old stone plunge bath, said to be Roman. The name Bakewell (Badcquelle of Domesday Book) is derived from its spring. The neighbouring STONEY-MIDDLETON has also similar waters.

The 'Hot-well' spring (only 73° F.) of CLIFTON (Gloucestershire), over which a building called 'Hot-well House' used to stand, was formerly famous, but is little known at present. It rises at the base of St. Vincent's rock, close to the River Avon. Clifton, with Clifton and Durdham Downs (altitude 230 feet to 310 feet), constitute a favourite climatic resort.

Mallo (Ireland, County Cork), a station on the railway from Dublin to Cork, possesses the only thermal (subthermal) spring in Ireland. The water has a temperature of 70° to 72° F. It was formerly much frequented by invalids.

Chaudfontaine (Belgium, Department of Liège), with a railway station 4½ miles from Liège, on the line to Aix-la-Chapelle, is beautifully situated in the Valley of the Vesdre, and possesses simple thermal waters (temperature 96° F.), known as early as the thirteenth century.

Schlangenbad (Germany, Prussian Province of Nassau).—This spa lies at an altitude of about 900 feet in a deep valley leading in a northerly direction from the Rhine, which is about five miles distant. Its situation, just at the bifurcation of the valley towards the north, renders the climate mild, though the air is sufficiently well ventilated. It is connected with Eltville on the Rhine by a steam-tram, and good carriage roads lead to Langenschwalbach and Wiesbaden.

The woodland and mountain scenery of the neighbourhood is unsurpassed, and miles of shady walks lead in every direction through the forest immediately surrounding the spa. A great variety of excursions may be made to spots in the Taunus Mountains and on the Rhine.

The water is simple thermal, exceedingly soft, rich (like rain

water or dew) in oxygen and nitrogen, and in the white glazed baths has a beautiful bluish tint. According to Fresenius (1878), the thermal water has a total solids of only 0·4 per mille, with 10 volumes per mille of nitrogen, and 3 of carbonic acid gas. There are nine different springs, the temperature of which varies from 81·5° to 89° F. Everything that can be expected from simple thermal waters and rest in pure fresh air, amidst delightful scenery, can doubtless be obtained at Schlangenbad.

The guests include persons requiring rest after overwork or work in unhealthy surroundings, convalescents, and patients suffering from simple dyspeptic troubles, neurasthenia and functional nervous troubles, and women suffering from those chronic gynaecological troubles which are likely to be benefited by simple thermal waters. The waters have a special reputation in slight cases of chronic skin eruptions and roughness of the skin, notably in patients (especially women) of excitable nervous temperament. Massage is to be obtained in suitable cases. Whey from cow's milk or goat's milk is employed in some digestive affections, and the chalybeate waters of the neighbouring Schwalbach are brought here for anæmic patients.

For the more robust types of cases spas possessing more active waters are usually preferable to Schlangenbad. The place is, however, sometimes used for an 'after-cure' by patients coming from Karlsbad, Marienbad, Kissingen, Ems, &c. There is, perhaps, no other spa which exercises so soothing an influence on the nervous system. The late Dr. F. Baumann by his great experience of the class of patients frequenting Schlangenbad had much to do with the success of the health resort and its good name in England. The season is from the beginning of May to the end of September.

Badenweiler (Grand-Duchy of Baden) is beautifully situated at an altitude of 1,370 to 1,470 feet in the southern portion of the Black Forest, on the north-western declivity of the Blauen, overlooking the Rhine Valley to the west. The town is sheltered on the north, east, and south by pine-clad mountains. West winds predominate, and the equable mild temperature renders the place a climatic health resort for delicate persons and those suffering from pulmonary affections. When more bracing air is required patients can reside at the more elevated 'Haus-Baden' (1,750 feet). A variety of excellent walks on the wooded slopes have been arranged for a 'Terrain-Cur.'

The temperature of the simple thermal springs of Badenweiler is 79° F., and according to Bunsen the water has a total solids of only 0·35 per mille; it is used more for bathing than internally. Besides the beautiful 'marble bath' there is another large bath open to the air, and smaller baths for separate patients

may likewise be obtained. Extensive remains of the ancient 'thermæ' show that the waters were used in Roman times.

The tepid baths of Badenweiler, aided by the climate, are used for much the same class of patients as are other 'Wildbäder.' Amongst the patients are convalescents, overworked delicate persons, chronic rheumatic and gouty cases, cases of chronic neuralgia, neurasthenics, and 'irritable nervous' subjects. The season lasts from May 1 to October 1. There is very good accommodation in hotels and private villas.

Badenweiler is more used as a climatic health resort and for rest after active courses of mineral waters than for bathing purposes. It is a good place for milk, whey, and grape cures.

Liebenzell, about 8 miles from Wildbad, is beautifully situated (altitude 1,100 feet) in a Württemberg Black Forest Valley, and has thermal springs similar to those of Wildbad, but the temperature is lower (72° to 82° F.), so that the baths have often to be artificially heated. This spa enjoys a special reputation in the treatment of gynecological affections. It is the 'Zellerbad' alluded to by Paracelsus in his 'Baderbüchlin' (1562), and in former times a course of baths commenced at Wildbad was sometimes completed with the cooler baths at Liebenzell.

Landeck (Prussian Silesia) possesses indifferent thermal springs, having a temperature of 68° to 83.3° F. The waters, which are used more for bathing than for drinking, contain minute quantities of sulphide of sodium and sulphuretted hydrogen, and were therefore formerly classed in the sulphur group. The spa is pleasantly situated at an elevation of 1,530 feet amidst wooded hills in the mountainous country of Glatz, close to the town and railway station of Landeck, and 18 miles distant from Glatz. There is good shelter on the north and east sides. The moderate altitude of the spa, the neighbouring woods, and the frequency of gentle breezes render the climate refreshing and moderately moist. Landeck has been termed a 'German Saint-Sauveur,' and is especially visited by ladies for chronic rheumatic, pelvic, and functional nervous affections. Besides the ordinary small separate baths there are large ones for several persons to sit in at the same time. The 'Marienbad' is an elegant modern structure with arrangements for baths in the lower part and dwelling rooms for patients in the upper stories. There are likewise facilities at Landeck for hydrotherapeutic treatment (Establishment of THALHEIM) and for whey and kephir cures. The paths on the surrounding hills are suitable for graduated walking exercise.

Warmbrunn (Prussian Silesia) is a summer resort in the Hirschberg Valley, situated on the northern declivity of the Riesengebirge, 1,130 feet above the sea. It possesses simple thermal springs, having temperatures of 77° to 109° F., which were classed formerly as sulphur springs, because three of the five

smell slightly of sulphuretted hydrogen. There is likewise a chalybeate spring, the 'Victoriaquelle.' The railway stations of Hirschberg and Reibnitz are about 4 miles distant.

Gastein (Wildbad-Gastein), in Austria (Duchy of Salzburg).—The place (altitude 3,430 feet) where the thermal springs arise is called Wildbad-Gastein (or Bad-Gastein) to distinguish it from Hof-Gastein (altitude 2,850 feet), which lies about 5 miles to the north, and is supplied through wooden pipes by the same waters. The Gastein Valley has a direction almost exactly southwards from Lend, and Wildbad-Gastein lies on the mountain slopes at the southern end of the valley, over the Falls of the Gasteiner Ache, which send up clouds of spray into the air. The position is almost completely sheltered from winds, the promenades are pleasant, and the surrounding mountain scenery is most imposing. Hof-Gastein lies in a broader part of the valley, nearer to Lend. The new railway from Schwarzach-St. Veit to Bad-Gastein was opened in 1905.

The numerous thermal springs (total solids 0·3 per mille, according to Redtenbacher) have temperatures ranging from 78·5° to 121° F.; and although peculiar electrical conditions are claimed for the waters, their action is probably that of simple thermal waters in general, aided by the mountainous climate. Yet it must be remembered that according to the investigations of P. Curie and A. Laborde and others (already alluded to) it is not impossible that radio-activity may have something to do with the therapeutic effects of the Gastein waters.¹

The waters are chiefly used for baths, and enjoy an old reputation in the treatment of nervous affections of various kinds, as well conditions of merely functional origin as chronic affections due to organic changes in the nervous system, such as tabes dorsalis. In true cases of the latter class only a limited amount of benefit can of course be anticipated. The hotter baths are used for neuralgias. In gout, rheumatism, chronic metritis, and the remains of inflammation in the female pelvic organs, they are of service like other 'Wildbäder.' The mountain climate plays an important part in the results obtained; it is sometimes of special

¹ See L. Wick, 'Ueber die Beziehungen der Radiumemanation in der Gasteiner Therme zu deren Heilkraft,' *Berliner klinische Wochenschrift*, 1906, Nos. 15 and 17. The amount of radio-activity in the various baths largely depends on their distance from the spring-heads. Thus, most of the radio-activity has already been lost when the water reaches Hof-Gastein, five miles off. See also H. Mache, 'Ueber die Radioaktivität der Gasteiner Thermen,' *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien*, 1904; also *Physikalische Zeitschrift*, vol. v, No. 15, p. 441. The term 'Gastein baths' has already been employed as synonymous with 'radio-active baths' (cf. p. 351). Of the Gastein springs the most radio-active is the Grabenbäckerquelle; then follow in order the Elisabeth-Stollen (Hauptort), the Wasserfallquelle, the Chorinskyquelle, the Elisabeth-Stollen (Südquelle) and the rest. For a comparison with the radio-activity of various springs of Baden-Baden and the Black Forest, and of Karlsbad, see footnote under Baden-Baden in Chapter XVIII.

service to convalescents and to patients coming from Karlsbad, Marienbad &c. for an 'after-cure.'

In some gouty cases, cases of nervous dyspepsia &c. the waters are likewise used internally. Dietetic management is facilitated by the restaurant arrangements, which much resemble those of the hotels at Karlsbad.

The season lasts from May 1 to the end of September, but the months of July and August form the main season; and, though the accommodation is good, during these months the place is so crowded with visitors that it is impossible to get rooms unless ordered some weeks in advance. The hotels and lodging-houses of Bad-Gastein and Hof-Gastein have baths of their own directly supplied with thermal water. Excitable persons who cannot bear noise ought to stay at some distance from the waterfall.

Voesslau, in Lower Austria (altitude 810 feet), is situated in a pretty country, on the railway about 30 miles south of Vienna. It possesses subthermal waters (temperature 75·2° F.) only used for bathing, and chiefly by ladies for functional nervous troubles, &c. It is one of the localities for the 'grape-cure.'

Teplitz (Teplitz-Schönau), in Bohemia.—This spa, which, since its union with the neighbouring village of Schönau, has been called Teplitz-Schönau, is the oldest spa in Bohemia. It lies in a broad open valley at an altitude of about 730 feet, and is sheltered on the north by the Erzgebirge, and on the south by the Mittelgebirge, of which the Königshöhe (870 feet), immediately overlooking the town, is a projecting spur.

The town possesses a considerable commercial importance, which tends somewhat to modify its character as a spa.

The weakly alkaline waters (Liebreich in 1898 found the total solids in the Stadtquelle 0·7 per mille, 0·4 per mille sodium carbonate) may be classed as simple thermal (83° to 114° F.). In February 1879 the supply at Teplitz was suddenly interfered with owing to the accidental tapping of a communicating spring in working a coalpit near Dux. It seemed at first as if the underground stream had been diverted from Teplitz, but, on a new boring being made in the town, the supply of water was re-established, and is now as plentiful as can be desired, though it has to be pumped up. The Teplitz Stadtquelle may now be obtained in bottles, artificially charged with CO₂, for use as a 'table water.'

There are many different bath-houses in Teplitz, the most luxurious of which is the Kaiserbad belonging to the town; in nearly all of these bath-houses patients can likewise be lodged. Besides the ordinary thermal baths there are baths of peat ('moor baths'), the peat being obtained for this purpose from the neighbourhood. The Teplitz peat contains much less iron, and is said to be less stimulating than that of Franzensbad and Karlsbad,

which two latter both derive their peat from the Franzensbad moor. The Teplitz 'moor bath' is given at a higher temperature (about 99.5° F.) than those of Franzensbad and Karlsbad (about 89.5° to 95° F.), and a greater anodyne effect is claimed. Massage may be obtained in suitable cases.

The patients who visit Teplitz are mostly sufferers from chronic rheumatic and gouty affections, sciatica, lumbago, neuralgias, or functional nervous affections. Temporary improvement is said to follow the treatment in some cases of commencing tabes. The baths are likewise used in chronic cutaneous eruptions, and in wounds and ulcers slow to heal. There are Austrian, Saxon, and Prussian military sanatoria at Teplitz. For internal use the waters of Karlsbad or Marienbad (to be obtained in the Kurgarten) may be employed in some cases, or those of the neighbouring alkaline springs of Bilin, or the bitter waters of Püllna, Sedlitz, and Saidschitz, near Teplitz. A stay at Teplitz is sometimes recommended as an 'after-cure' to spa-treatment at Karlsbad, Marienbad, Franzensbad, &c.; but Teplitz was probably formerly more used for this purpose than it has been recently, patients being now more often sent to mountain resorts.

The season at Teplitz lasts from May to the end of September, but patients are received throughout the year.

Johannisbad (Bohemia) lies at an altitude of about 2,070 feet in a mountainous region to the south of the Riesengebirge. Its waters belong to the simple thermal class, and have a temperature of 85° F. The effect produced in cases of prolonged convalescence, general weakness, and functional nervous disorders, is partly owing to the exhilarating nature of the climate. There is a weak chalybeate spring in the neighbourhood, containing, according to Schierholz (1895), 0.01 per mille bicarbonate of iron. Sometimes patients rest for a few weeks at Johannisbad after treatment at Karlsbad, Marienbad, &c. The season is from May 15 to the end of September. According to Knaur, the pleasantest time for a visit is during the end of August and September, when the weather is usually settled and the air especially clear. Johannisbad is 1½ miles from Freiheit, the terminus of a branch railway from Trautenau.

Römerbad and Tüffer (Styria, Austrian Empire), both stations on the railway from Graz to Trieste, lie near to each other at an altitude of about 820 feet, and possess simple thermal waters (temperature 95° to 102° F.). Römerbad, like Schlangenbad, has a name for functional nervous affections and chronic disorders of the pelvic viscera in women.

Tobelbad, an ancient spa in Styria (also called DOBBELBAD), lies at an altitude of 1,090 feet. Its two simple thermal springs

have temperatures of 77° and 83·5° F. The railway station is 25 minutes distant.

Neuhaus, in Styria, formerly called **TÖPLITZ BEI NEUHAUS** (altitude 1,200 feet), is pleasantly situated a few miles from Tüffer and the railway station of Cilli. Its simple thermal waters have a temperature of 98° F. There is likewise a chalybeate spring.

Buda, or Ofen, forming with Pest, on the opposite side of the Danube, the city of **Buda-Pest**, capital of Hungary, possesses simple thermal and thermal sulphur waters, with commodious thermal establishments. The **Margarethenbad** on the **MARGARETHEN-INSEL** in the Danube and the large **Kaiserbad** must specially be mentioned on account of the excellence of their arrangements. In the neighbourhood of Buda-Pest are the well-known sources of the purgative 'Hungarian bitter waters,' some of which, such as the **Hunyadi Janos**, **Franz-Josef**, **Æsculap**, and **Apenta** waters, are largely exported.

Amongst waters of Germany and Austria-Hungary which belong to the simple thermal group the following may also be mentioned :

WIESENBAD and **WOLKENSTEIN** (Warmbad near Wolkenstein), in the kingdom of Saxony, **SULZBACH**, in the Baden Black Forest, **VILLACH**, in Carinthia, with altitudes of between 1,000 and 1,600 feet; and **BRENNERBAD** (altitude 4,390 feet), in Tyrol, at the top of the Brenner Pass; these all possess waters having the relatively low temperatures of 70°–85° F.

VELDES (Upper Carniola) is beautifully situated at an altitude of 1,560 feet on the Lake of Veldes, in the Savethal. It possesses a subthermal spring of 80° F., but is better known as a summer resort, where treatment by sun baths and hydrotherapeutics can be obtained. The railway station (**Lees-Veldes**) is $\frac{3}{4}$ hour distant.

RAJECZFÜRDÖ, formerly called **RAJECZ-TEPLITZ**, situated in Upper Hungary, 1,374 feet above sea-level, 1 hour from the railway station of Sillein, possesses thermal waters (temperature 91·5° F.) which contain minute quantities of iron and alum, but may be ranked in the simple thermal group.

GROSSWARDEIN (**NAGYVARAD**), the chief town of **Comitat Bihar**, has simple thermal springs of 93° to 106° F., and **STUBNYA**, in **Comitat Turocz**, situated in the Carpathian Mountains at an altitude of 1,700 feet above sea-level, possesses still warmer ones (104°–115·5° F.). Other simple thermal springs are those of **KRAPINA-TEPLITZ** (altitude 530 feet, and temperature of waters 99·5° to 110° F.) and **TOPUSKO** (temperature of waters 122° to 135° F.), both in Croatia, and of **DARUVAR**, in Slavonia

(temperature of waters 104° to 117° F.). The springs of Daruvar were known to the Romans, and so were those of ALGYOGY (88·7° F.) in Comitatus Hunyad.

Loèche-les-Bains, or Louèche-les-Bains (in German, **Leukerbad**), in Switzerland (Canton of Valais).—This spa, the hot springs of which were certainly employed early in the fourteenth century, and, to judge from the results of excavations, were probably known to the Romans, has an altitude of about 4,600 feet, and is situated at the southern commencement of the Gemmi Pass, about 3½ hours' drive from Louèche-Souste, a railway station on the line from Lausanne to Viège.

The climate is that of high Alpine valleys, fairly well sheltered from cold winds. It may be hot in the middle of the day during the season, but the sun rises late and sets early, owing to the mountain heights around the spa. The warming of the rocky cliffs assures sufficient ventilation of the air, even in the absence of regular winds. During June to September the mean temperature at 1 P.M. is calculated by de Werra as about 60° F., whilst the mean temperatures at 7 A.M. and 9 P.M. are about 50° F. The average relative humidity during the same months is about 68 per cent. of saturation.

The waters have been classed in the simple thermal group,¹ though, according to Lunge (1885), they have a mineralisation of 1·9 solid parts per mille (1·4 sulphate of calcium), and, like the waters of Bath and Bormio, may equally well be placed in the earthy group. The temperature of the springs is from 102° to 124° F., the Saint-Laurent spring being the warmest. There are about twenty different springs, but only a few are made use of.

The climate is doubtless of great assistance to the balneotherapeutic treatment, which consists chiefly in long and short baths. Hydrotherapeutic treatment and the Aix douche-massage are likewise made use of in suitable cases. The waters are sometimes employed internally in daily doses of one to five glasses, and have a diuretic effect, and a sedative action in some cases of gastric irritability.

The short baths are employed in functional nervous affections and the same class of cases as ordinary thermal baths, but the prolonged bath treatment forms a kind of speciality of this spa. Usually the spa guests are advised not to begin the baths immediately after their arrival, but to wait a day or two until the fatigue of the journey has quite passed off, and they have got accustomed to the elevation. The prolonged baths are taken at a temperature of 93° to 95° F. and last one to six hours. Ladies

¹ The predominant external use of the waters justifies their classification in this group.

and gentlemen clothed in woollen garments bathe in large baths (a partition separating the sexes), where they can take light refreshments and play chess, draughts, dominoes &c. on floating tables.

July and August are the chief months for the cure, and at that time patients begin to arrive at the baths by five o'clock in the morning, and usually take a cup of tea, coffee, or chocolate in the bath. After the bath they usually go back to bed for half an hour or an hour, then take a short walk, and are ready at 11 o'clock for a proper meal. At about 3 P.M. the afternoon bath commences, and is likewise often followed by a rest in bed. At 6 is the chief meal of the day, followed by music &c. in the evening. The duration of the day's bathing is at first only an hour, and is gradually increased.

About the tenth or eleventh day the patients expect to see a skin eruption appear, which is called the 'poussée.' It is polymorphic, varying from a slight redness to a moist dermatitis, and may be accompanied by constitutional symptoms, loss of appetite, &c. According to the spa doctors, it lasts from ten to fourteen days, and is absent in 9 per cent. of the cases. A looseness of the bowels sometimes occurs instead of the eruption.

The prolonged baths are found useful in quite chronic skin affections, including chronic cases of eczema, psoriasis, lichen, &c. Their effect probably depends in great part on the maceration of the superficial epidermis, on increase of the capillary circulation in the skin, and on the stimulation manifested by the *poussée*. E. de la Harpe points out that the Loèche treatment in its external irritative effects resembles that of stimulant external pharmaceutical applications employed in cutaneous affections. In acute eczema, in certain irritable and pruriginous forms of chronic eczema, and in psoriasis during periods of exacerbation and extension, he thinks Loèche should not be recommended. The elevation above sea-level, which by itself exercises an indirect influence on the skin, may aid the other treatment in patients whose general condition is suitable for residence in high altitudes. Hot douches and douche-massage can be employed when indicated. The season lasts from June to September.

Saint-Amand, France (Department Nord).—The town (altitude about 100 feet) is situated between Lille and Valenciennes, on the vast plain of that part of France. The thermal establishment is about 2 miles from the town on the border of a large forest, in which there are plenty of shady walks.

Its weakly mineralised waters, of which the 'Fontaine-Bouillon' was possibly known to the Romans, have, according to Willm's analysis of 1895, a total solids of 1.3 per mille (0.6 sul-

phate of calcium), and are best classed in the simple thermal (subthermal) group, although there is a faint smell of sulphuretted hydrogen. The temperature is about 79° F.

The water is used for drinking at meals, &c., but Saint-Amand is chiefly known for its mud baths, for which a peculiar soil dug out from the neighbourhood of the springs is used. This soil contains some carbonate of iron and a considerable amount of sulphuretted hydrogen gas; it is prepared for use with the thermal water. The temperature at which the baths are given is about 98° F. or higher. The time for taking them is the early morning; they are heated on the preceding day.

Most of the patients take their mud baths in a large circular building (the rotunda). The floor of this is divided into a great number of compartments, one of which is filled with mud for each person at the commencement of his treatment, so that no one need bathe in mud already used by anyone else, though a single lot of mud lasts a patient for his whole course of baths. Patients remain from one-half to five hours in the mud, but they can read and write, or converse and play cards with their neighbours, or otherwise amuse themselves. The part of the body not immersed is covered with a loose garment. For entering the bath and leaving it curtains can be let down around each compartment, and patients can bathe in private rooms if they prefer it. The baths are of course followed by a short ordinary bath or douche, which washes off the mud.

Hydrotherapeutic treatment, massage &c. are also made use of, accordingly as the doctor thinks desirable.

The mud baths are employed in rheumatoid arthritis and chronic rheumatic affections, neuralgias, stiff joints resulting from injury, and some chronic skin affections. H. Thiroux claims for them excellent results in relieving the trophic disturbances associated with varicose veins of the lower extremities ('varicose eczema,' &c.). In some nervous affections, and notably in relieving the pains of *tabes dorsalis*, satisfactory results are likewise recorded. The season lasts from June to the end of September. The station of Saint-Amand is on the railway between Lille and Valenciennes. There is likewise a nearer station, 'Fontaine-Bouillon,' on a local line.

Plombières, France (Department of Vosges).—The town (altitude 1,300 feet) is built on the banks of the Augronne stream in a rather narrow valley of the Vosges Mountains. The waters belong to the simple thermal class (77° to 155° F.), but contain minute quantities of arsenic. Some of the springs impart a peculiarly 'unctuous' sensation, due to the presence of silicate of aluminium (on the possible action of silicates in simple thermal waters see Chapter XIV). These are hence called 'Sources Savonneuses.' According to the researches of P. Curie and A. Laborde, it is not impossible that radio-activity may have something to do with the therapeutic effects of the Plombières waters.¹

¹ Cf. F. Bernard, of Plombières, *loc. cit.* Amongst French thermal and mineral waters the greatest amount of radio-activity is shown by Plombières springs, though some thermal springs of Gastein (Austria) are still more radio-active, that is to say, when the water freshly obtained from the spring-head is tested.

There are several bath establishments, the best of which is the new one constructed under Napoleon III. An ancient Roman sudatorium, now connected with the Stanislas establishment, is still used as a hot vapour bath, the hot vapour for which is supplied by the natural thermal water. It is largely to Napoleon III. that the spa owes its modern improvements.

The indications are those for simple thermal treatment in general. The waters are employed to some extent for drinking and inhalation, but chiefly for warm baths, douches, and intestinal douches (lavage of the large intestine). Before the patient leaves the bath a douche (of rather higher temperature than the bath water) is sometimes directed through the water of the bath against the affected part. Massage is prescribed when necessary, and vapour baths are employed in some rheumatic cases. Sometimes the weak non-gaseous chalybeate 'Source de Bourdeille' is employed internally instead of the ordinary thermal water. —

Plombières has a good reputation in the treatment of gastralgia, nervous dyspepsia, chronic catarrhal enteritis, the so-called muco-membranous colitis (notably cases associated with much pain), chronic diarrhoea, and functional nervous disorders, especially in arthritic subjects; also for chronic inflammatory conditions of the uterus, the chronic remnants of localised peritonitis, and notably for the pains and other chronic troubles often following perityphlitis (appendicitis),¹ whether the appendix has been removed by operation or not.

What is known in England as the 'Plombières treatment' for muco-membranous colitis &c. comprises: (1) intestinal douches, (2) sedative warm baths, and (3) 'under-water' douches directed against the abdomen; but these three parts of the treatment are not necessarily employed altogether. The intestinal douche (for which the Source des Dames is employed) is given with the patient reclining on a couch so that a regular lavage of the large intestine is effected. It is termed a 'douche horizontale' to distinguish it from the 'douche ascendante' or rectal douche for which the patient is seated on a stool. This intestinal or 'horizontal' douche is employed in cases of muco-membranous colitis and chronic diarrhoea; in chronic metritis the douche should not reach higher than the rectum. The sedative baths are given at 95° to 98·6° F. and the 'Tivoli' douches at higher temperatures. A 'douche Tivoli' at Plombières is a hot douche (3·5° to 5·5° F. hotter than the bath) given after the patient has left the bath; it is generally applied to the whole body, though specially directed to affected parts (sciatica, lumbago &c.), and is sometimes accompanied by massage, as at Aix-les-Bains, Vichy &c. What is, however, often spoken of in England as the 'douche Tivoli' of Plombières is the hot (about 107·5° to 111° F.) 'under-water' or 'submarine' douche directed under the water of the bath against the abdomen.² The baths usually last 40 to 50 minutes; the under-water

¹ *Vide* Skene Keith, 'The Treatment of some Forms of Appendicitis at Plombières without Operation,' *Lancet*, March 3, 1900, p. 645.

² For information on the subject of the Plombières treatment we are much indebted to Dr. Bottentpuit, who we believe is the real inventor (1874) of the Plombières under-water douches, which have since then been introduced at many other spas, and are beginning to be termed 'Tivoli douches' in England. By the under-water method the force of the shock of the douche is lessened, so that it is admirably suited for the abdomen and tender parts.

douches last five to ten minutes and are given just before the patients leave their baths.

The Plombières season lasts from the end of May to the middle of October. The mornings are mostly occupied with the thermal treatment, and the time between the midday meal (at eleven or twelve o'clock) and dinner (at six or seven) is usually free for promenades, excursions, &c. There are interesting excursions to be made in the neighbourhood. Amongst the shorter ones is the gentle uphill walk of $1\frac{1}{2}$ hours through a beautiful wood to the fountain of King Stanislas. The salts obtained from the Plombières waters are exported for home use (baths).

Bains-les-Bains lies at an altitude of 980 feet in a valley of the Vosges Mountains. It possesses many simple thermal springs (temperature 84° to 122° F.), similar to, but much less used than, those of its neighbour Plombières. They had a reputation in functional nervous disorders.

Luxeuil-les-Bains, in France (Department of Haute-Saône). The town of Luxeuil (altitude 1,300 feet) lies on fairly level ground at the western foot of the Vosges Mountains, about $12\frac{1}{2}$ miles from Plombières (railway station between Aillevillers and Lure). Roman remains exist at the former as at the latter spa.

The simple thermal springs, which contain minute amounts of common salt, iron, manganese, and arsenic, vary in temperature from 93° to 125° F.; they are used chiefly in the form of baths and douches for the class of cases usually benefited by simple thermal methods, especially for affections of the female pelvic organs and neurasthenia. The thermal water is likewise used for vaginal and rectal douches. The 'Source du Puits Romain' and the 'Source du Temple' (temperature 82° F.) are non-gaseous chalybeates. The arrangement of the patient's day is very similar to that at Plombières and other French spas where baths form the chief part of the treatment. The season is from the end of May to the end of September.

Aix-les-Bains, in France (Savoie).—This spa has for convenience been classed in the sulphurous group (Chapter XXV).

Aix-en-Provence (Department of Bouches-du-Rhône), the 'Aquæ Sextiæ' of the Romans, and the ancient capital of Provence, is situated at an elevation of 590 feet, on the railway route between Marseilles and Grenoble. Its simple thermal waters have a slightly variable temperature of about 91° F. (as measured at the establishment itself). They were supposed to have lost some of their therapeutic virtue in the time of the Roman Emperor Augustus.

Néris, in France (Department of Allier).—Néris (altitude 1,150 feet), pleasantly situated on an elevated plateau to the south of Montluçon, was known to the Romans, as the abundant Gallo-Roman remains testify. Its alkaline waters (0.45 per mille of

bicarbonate of sodium, 0.36 per mille of sulphate of sodium) are so feebly mineralised that they are best classed in the simple thermal group.

Néris has an excellently arranged thermal establishment for baths, douches, hot vapour baths, massage, &c. It has also a hospital for poor patients requiring thermal treatment.

The waters of the Néris wells have temperatures ranging from 102° to 126° F.; they are chiefly employed externally. A greenish spongy substance (limon) is formed in the thermal reservoirs. It is due to the growth of *confervoideæ*, and resembles the material found in the similar and neighbouring waters of Evaux-les-Bains. Like the latter, it is sometimes employed as a local application, but not so much as it was formerly. The action of the Néris baths is sedative, although some form of 'well-fever' or 'poussée' often appears, according to De Ranse, between the fifth and twelfth days of treatment. The affections treated include chronic rheumatic and gynecological complaints, especially when occurring in nervous, excitable subjects; so also sciatica and neuralgias. Néris has a good reputation in the treatment of functional nervous disorders, including neurasthenia, hysteria, some forms of nervous 'pseudo-angina pectoris,' &c., at least in cases where a sedative effect is desired. The baths may likewise exert a palliative influence in the pains &c. of *tabes dorsalis*.

Prolonged baths are sometimes employed for hysteria. The douche-massage has been introduced after the manner of Aix-les-Bains, for the treatment of rheumatic cases, &c.

The season extends from May 15 to the end of September. Néris is 3 miles distant from the railway station of Chamblet-Néris. It may sometimes be more convenient to take the omnibus or a carriage from Montluçon (5 miles in $\frac{3}{4}$ hour).

Evau-les-Bains (France, Department of Creuse).—The Thermal Establishment (altitude 1,500 feet) is situated in a pleasant park, close to the ancient town of Evaux, and about 1 mile from its railway station (on the line between Montluçon and Eygurande). It has several springs of simple thermal water (temperature 79°–134° F.), analogous to those of Néris, rich in nitrogen and organised material. This latter, consisting of *confervoideæ*, forms a thick greenish sponge-like material, which floats on the surface of the water, and is called 'limon' by the inhabitants of the country, who sometimes apply it locally to wounds and abrasions, &c. One of the springs is slightly sulphurous, perhaps due to the action of the living organisms contained in it. An ancient circular piscina and other remains are thought to show that the thermal waters were made use of in Gallo-Roman times.

The treatment (baths, douches, and hot vapour baths) is almost entirely external. The patients, who at present come chiefly from the neighbouring Departments, have the convenience of being able to lodge in the same building in which they take their baths.

Mont-Dore (France), in the Auvergne. (See Chapter XXIV.)

Châteauneuf (France, Puy-de-Dôme) is described in the simple alkaline group (Chapter XIX).

Chaudes Aigues (France, Department of Cantal).—The village is situated at an altitude of 2,050 feet, in a narrow valley, about 3 hours' driving distance from the railway station of Saint-Flour. Its waters, said to be the hottest in France, are feebly alkaline (0.48 per mille of carbonate of sodium), and contain minute quantities of the iodide and bromide of sodium, but are best classed among the simple thermal waters. The temperatures of the principal springs range from 135° to 180° F. The season is from June 1 to September 15, and the patients are mostly from the neighbourhood.

Sylvanès (France), in the Department of Aveyron. (See Chapter XXIV.)

Sail-les-Bains, or **Sails-les-Château-Morand** (France, Department Loire), lies in a valley at an altitude of about 820 feet. Its weakly mineralised springs (temperature 79°–93° F.) may be classed in the simple thermal group. These tepid waters contain about 0.13 silicates per mille, to the possible therapeutic value of which, according to J. Felix, we have already alluded in the paragraph on solutions of alkaline silicates in Chapter XIV. There are likewise a sulphurous and a weak cold ferruginous spring. The nearest railway station is Saint-Martin-d'Estreux, 3 miles to the south-west. The spa is situated in extensive grounds.

Saint-Laurent-les-Bains (France, Ardèche) is situated in a picturesque gorge, at an altitude of about 2,700 feet, 6 miles from the railway station of La-Bastide. Its simple thermal waters have a temperature of 128° F.

Foncaude (altitude 130 feet), in the Department of Hérault, near Montpellier, has simple subthermal waters (78° F.).

Avène, in the same Department (altitude 980 feet), has weakly mineralised waters with a temperature of 81° F.

Alet (altitude 650 feet), in France (Department of Aude), has a railway station, 22 miles south from Carcassonne on the line to Quillan. Its weakly mineralised alkaline springs have temperatures of 64° to 102° F. The thermal establishment is open all the year. The water of Alet is exported in bottles as a pure table water like that of Évian (see Chapter XXVII).

Campagne-sur-Aude (France, Department of Aude), about

1 mile from the railway station, possesses feeble mineralised, slightly ferruginous springs, which may be classed in the simple thermal (subthermal) group (temperature 68° to 79° F.). Campagne (altitude 820 feet) was probably more visited in the sixteenth century than it is at present.

Rennes-les-Bains (France, Aude).—The first class of waters mentioned in the description of this spa (Chapter XXIII) may be placed in the simple thermal group.

Dax (France, Department of Landes).—The town (altitude about 130 feet) lies on the left bank of the Adour, and is a railway station on the line from Bordeaux to Bayonne, 32 miles from the latter town. Dax was the Roman¹ 'Aquæ Augustæ Tarbellicæ,' and derived this name as well as its present name from its hot springs (Dax, De Aquis), which may be classed in the simple thermal group. The temperature of the Dax water is 88° to 140° F., but at the source of the famous 'Fontaine Chaude' it has been ascertained to be as high as 147° F.

The thermal water is used for baths and douches at different temperatures. It is sometimes employed internally, and it is likewise used to form hot vapour baths, general and local, for the treatment of chronic rheumatic affections &c. The inhabitants also use it for domestic purposes.

The mud of the 'mud baths,' for which Dax has a great reputation, is formed by the action of thermal water on the banks of mud left from the periodical inundations of the river Adour. These baths are used for chronic rheumatism, stiff joints, neuralgias, sciatica, uterine and functional nervous affections. They are given at a temperature of 86° to 113° F. and occasionally even as high as 122° F. Local applications of the mud are preferred to the ordinary mud baths, according to Dr. Larauza, in very anæmic or in extremely plethoric persons, in cases where only one joint is affected, in cases where some region (such as the cervical or scapulo-humeral region) is affected, but cannot be immersed in the ordinary mud bath, in cases where some grave cardiac or other affection renders the ordinary mud bath inadvisable, and finally in certain very chronic affections, where very long application to the affected part is required (such as some cases of chronic synovitis &c.).

From SAINT-PANDÉLON, about 3 miles distant, a brine is conducted subterraneously to Dax, very similar to that of Briscous (see Chapter XVIII under Biarritz); it is used for baths and douches at different temperatures in a separate well-arranged establishment adjoining the Casino. Scrofulous and delicate persons may thus be treated.

The Grand Hôtel des Thermes (facing the Casino and the

¹ Part of the old Gallo-Roman walls of Dax still exists.

establishment for brine baths) provides thermal and mud baths and hydrotherapeutic treatment. So does the Bagnots establishment.

The climate somewhat resembles that of Pau, but is slightly warmer and more humid. Dax is therefore occasionally used also as a climatic station, and is open all the year, forming a winter as well as a summer resort. The mean winter temperature is about 46° F.

About 10 miles distant from Dax is the little resort of PRÉCHACQ-LES-BAINS, which has thermal waters and mud baths quite analogous to those of Dax.

Bagnères-de-Bigorre (France, Hautes-Pyrénées) will be described in the earthy group (Chapter XXVI).

Ussat (France, Department of Ariège) lies at an altitude of 1,590 feet in the valley of the river Ariège. Its weak alkaline earthy water (temperatures in the baths form a series of 89·6° to 100·4° F.) may be ranked in the simple thermal group, and is chiefly employed in the form of baths of running water and douches for chronic gynaecological and hysterical affections. Ussat, likewise famous for its immense cavern of Lombrive, where remains of prehistoric man have been found, is a station on the railway between Toulouse and Ax, about 14 miles from the latter place.

Bagnoles-de-L'Orne (France, Department of Orne) lies at an altitude of 530 feet amidst the picturesque country called the 'Norman Switzerland.' Its weakly mineralised waters, having a faint odour of sulphuretted hydrogen, may be classed in the simple thermal group (temperature 81° to 84° F.). The medical men of the spa have made a special study of the constitutional tendencies to chronic phlebitis. Bagnoles is a station on a branch line from Briouze of the railway between Paris and Granville.

Bormio (German, Worms) lies in the upper Valtellina valley in Italy, near the Swiss and Tyrolese frontiers, on the southern slope of the Stelvio. The altitude of the New Baths is about 4,500 feet; the Old Baths lie about 200 feet higher. The springs contain a small amount of bicarbonate of calcium and of the sulphates of calcium and magnesium, but may conveniently be classed with the simple thermal waters (temperature 91° to 105° F.). They were referred to by Pliny the elder, and were employed under the Ostrogoth Theodoric the Great early in the sixth century. In the fourteenth century they were recommended for gout by a professor at Bologna, Petrus de Tussignana, who visited them (1363) and wrote the first book about them. In Germany the baths ('Wormserbad') had a great reputation. They are now visited for chronic rheumatism, gout, and the 'uric

acid diathesis,' also for chronic cutaneous eruptions. Douches and mud baths are employed, as well as the thermal baths.

At Santa Catarina (Chapter XXIII), about 3 miles distant, are chalybeate waters, sometimes used by anæmic patients staying at Bormio. The climate aids the cure in scrofulous and neurasthenic patients. Owing to the sudden fluctuations in temperature, warm clothing must be brought. The season lasts from June 1 to the end of September. Bormio can be reached from the railway station of Sondrio by diligence in 10 hours; from the station of Meran in $17\frac{1}{2}$ hours; from the station of Landeck in 22 hours; or from Samaden in the Upper Engadine via the Bernina pass in about 12 hours.

Battaglia (Italy, Province of Venice) is situated at the eastern foot of the isolated Euganean Hills, not far from Abano.¹ The chambers in the rocks here are partly artificial. They are used, like the better known grotto of Monsummano, as 'stufe' or natural vapour baths, with a temperature of 110° to 116° F. The four springs, having temperatures of 136° to 160° F., contain, according to Schneider (1874), 1.5 per mille common salt, but no sulphur, as they were formerly supposed to do; they, therefore, are best classed amongst simple thermal waters. Chronic gout and rheumatism and rheumatoid arthritis are treated. For bronchial catarrhs there is a special room for the pulverisation and inhalation of the waters. Local mud baths are employed in a similar way to those of Abano and Acqui; these mud baths of Battaglia have become quite famous, and the mud ('fango') is exported to several other spas (amongst others to Matlock in England) and to several great cities, such as Berlin,² for patients who cannot come to Battaglia. Massage can be performed in suitable cases. The season is from the beginning of May to the middle of October, but the baths are open all the year. Battaglia is a station on the railway between Padua and Bologna.

Monsummano (Italy, Province of Lucca) lies in the Val di Nievole, about half an hour distant from the railway stations of Pieve and Montecatini. A large cave, the 'Grotto of Monsummano,' warmed by large surfaces of natural thermal water, is used as

¹ The term 'Euganean thermæ' includes Battaglia, Abano, and some less known springs (see Chapter XVIII, under Abano). Of these thermæ Battaglia is probably the most important.

² At many places the mud has to be specially prepared and artificially mixed with thermal water before it is ready for use. Battaglia is saved considerable expense by the mud being already naturally mixed with the thermal water. As only a limited amount is required for treatment at Battaglia itself, much can be exported. A regular 'Fango-Kuranstalt' was established at Berlin in 1897. Fango is likewise exported from Montegrotto and probably from other places in Italy. The fresh thermal water of Battaglia is radio-active, but the fresh 'fango' was found by Elster and Geitel (*Physikalische Zeitschrift*, 1904, v. p. 11) to contain actual radium (like many spring-deposits), not merely radio-active emanations (like many thermal and mineral waters).

a vapour bath for painful rheumatic and gouty affections, lumbago, sciatica, neuralgias, &c. Discovered accidentally in 1849 by the father of the poet Giuseppe Giusti, it became well known owing to the visits of Garibaldi (1867), Kossuth (1871), and others. The spacious interior, lined by stalactites and stalagmites, is carefully kept clean, and is illuminated by electric lights. It is fancifully divided into a 'Paradiso,' a 'Purgatorio,' and an 'Inferno.' The temperature of the latter, the hottest portion of the cavern, is about 95° F.; that of the natural thermal lakes is about 92°–95° F. The patients, men and women, clad in comfortable dressing gowns, walk about or rest in the grotto, and mostly perspire freely in spite of the temperature being relatively low for a vapour bath. After remaining there for the prescribed time, generally about an hour, they rest on couches as after ordinary forms of sweating baths. A tepidarium has been added to the natural cavern, and there is a large tepid piscina for a plunge. Arrangements have likewise been made for hydrotherapeutic treatment. The season is from April or May to September. Patients can either stay at the modern hotel adjoining the grotto, or at Montecatini, which is only about 2 miles distant.

Valdieri (North Italy, Piedmont) lies at an altitude of 2,485 feet in the Valley of the Gesso, 5½ hours' distance south-west of the railway station of Cuneo. The spa ('Bagni') is situated at an altitude of 4,425 feet, 8 miles from Valdieri village. Of its thermal springs, the Sorgente San Lorenzo has a temperature of 156° F. The waters are used internally and externally; a slimy substance or mud, consisting partly of organic material, is collected from the bottom of the springs, and used in the form of local or general applications to the skin, like the 'fango' of Battaglia, Abano, and Acqui. The affections treated at Valdieri include skin diseases, chronic rheumatism, rheumatoid arthritis, and scrofula.

Pré-Saint-Didier (Northern Italy, Duchy of Aosta), near Courmayeur, lies at an altitude of about 3,280 feet, and possesses weakly mineralised thermal waters (95° F.), used for bathing only.

San Giuliano (or **Bagni San Giuliano** or **Bagni di Pisa**) has a railway station of its own, and is only 3½ miles from the ancient city of Pisa. The thermal springs (91°–106° F.), known from an early period, contain over 1 per mille sulphate of calcium, but may conveniently be classed, like those of Bath (Great Britain), in the simple thermal group. Not far off is the gaseous spring of ASCIANO, which can be used as a 'table water.'

Casciana ('Balneum de Aquis'), in the Province of Pisa, 10 miles from the railway station of Pontedera, has thermal waters (96·8° F.), containing about 1·7 per mille sulphate of calcium. In the neighbourhood there is likewise a gaseous

muriated alkaline chalybeate spring, called the 'ACQUA ACIDULA,' which, according to Romei (1885), contains 2·2 per mille common salt, 1·4 bicarbonate of calcium, and 0·07 bicarbonate of iron.

Vicarelo, 16½ miles from Rome, has thermal waters of 113° F., which are said to be the 'Aquæ Apollinares' of Roman times.

Ischia and Pozzuoli, in Italy. See amongst the muriated alkaline waters (Chapter XX).

Panticosa, in the Spanish Pyrenees (altitude 5,600 feet), is described amongst the sulphur baths in Chapter XXV.

Caldas-de-Malavella (Spain, Province of Gerona) possesses very hot weakly mineralised springs (temperature up to 140° F.), containing under 1 per mille solids, chiefly chlorides of calcium and magnesium. They are best classed in the simple thermal group, and are used for domestic purposes as well as for the treatment of patients.

Fitero (Spain, Province of Navarra) (altitude, 740 feet) possesses weakly mineralised waters (temperature about 117° F.), which have an old reputation in the North of Spain for chronic rheumatic affections, rheumatoid arthritis, &c. They contain under 0·5 per mille solid constituents, and may be classed in the simple thermal group.

Urberoaga-de-Alzola (Spain, Province of Guipuzcoa, a few hours' drive from San Sebastian) is situated in a gorge with beautiful environs. It possesses very weakly mineralised alkaline earthy waters (temperature about 87° F.), and has been very misleadingly called the 'Spanish Vichy.' It has a reputation in affections of the bladder and urinary organs.

Urberoaga-de-Ubilla (Spain, Province of Biscaya) (altitude about 180 feet) possesses weakly mineralised waters (temperature 80° F.), said to be rich in free nitrogen gas. There are arrangements for inhalation treatment (compare Lippspringe, in Germany, Chapter XXVI). The place has a reputation in chronic catarrhal conditions of the respiratory organs.

Caldas-de-Oviedo (Spain, Province of Oviedo) (altitude 245 feet) possesses weakly mineralised thermal waters (105° F.) rich in nitrogen gas. It is frequented for chronic rheumatism and chronic affections of the respiratory passages. There are arrangements for inhalation treatment.

Sacedon, or **LA ISABELLA** (Spain, Province of Guadalajara), possesses thermal waters (temperature 84° F.), containing a total of about 0·75 per mille solids, chiefly sulphate of calcium. These waters, which were known to the Romans and the Arabs, are best classed in the simple thermal group.

Alhama-de-Aragon (Spain, Province of Zaragoza) has a pleasant situation at an altitude of about 2,000 feet. Its waters

have a temperature of about 95° F. and are best placed in the simple thermal group. The establishment, which is one of the best in Spain, is kept open throughout the year.

Alhama-de-Granada (Spain, Province of Granada) has simple thermal waters (113° F.). The baths had a great reputation under the Moors;¹ and the 'Bano de la Reina' is probably of Roman origin. The situation is in a hilly country about 2,000 feet above sea-level.

Caldas-de-Gerez (Portugal, Province of Minho) lies in the mountains of Gerez, and possesses very hot weakly mineralised waters, which contain carbonic acid gas and a little iron. The water runs into hollows cut into the rock, and is used in the form of hot baths for chronic rheumatism and neuralgias. It is likewise taken internally. The accommodation might be much improved.

Abbas-Tuman (Russia), in the central government of Tiflis, is situated amidst pine forests and rocky heights in the Caucasus, at an elevation of 3,505 feet above sea-level. It has simple thermal springs (110° to 120° F.) and a military thermal establishment. Its mountain climate has been considered a satisfactory one for some cases of pulmonary tuberculosis, and the late Grand Duke George of Russia had his residence here.

Hammam R'Irha, in Algeria, has already been described in Part I. The place is situated on a terrace of the Lesser Atlas Mountains, at about 1,800 feet above sea-level. It possesses cold and hot springs, but it is chiefly known for the latter, which were already employed in Roman times. The cold gaseous earthy chalybeate waters are used for drinking. The hot springs (highest temperature 153° F.) are chiefly used externally, and for practical purposes, like the thermal springs of Bath, in England, may be classed in the simple thermal group, though, like the latter, they contain about 1·5 per mille calcium sulphate (total solids about 2·7 per mille). The baths are open throughout the year, but are most frequented by Northern visitors in spring and autumn (November). The same class of gouty, rheumatic, and neuralgic patients are benefited as are relieved by treatment at Bath, Aix-les-Bains, and other thermal baths of Europe. Hammam R'Irha was the 'Aquæ Calidæ' of the Roman Empire.

In concluding this chapter it may be observed that some thermal springs described elsewhere as weak muriated (e.g. Baden-Baden and Bourbon-Lancy), thermal chalybeate, or thermal sulphurous, might likewise, from the therapeutic point of view (external methods of application), be included in the simple thermal group.

¹ Alhama is the Arabic equivalent for bath.

CHAPTER XVIII

MURIATED, CHLORIDE OR COMMON SALT WATERS

(WITH A NOTE ON SEA WATER AND SEA-WATER BATHS)

External use.—Salt baths have a more stimulating action than baths of plain water. The salt water soaks through the epidermis and acts as a chemical excitant to the nerve-endings in the skin; to this is partly due the special stimulating effect of sea-water (the ordinary natural salt water for bathing) as compared with river water. In some sensitive skins too much irritation may be caused, giving rise to urticaria or increasing an eczematous eruption.

The ‘Soolbäder,’ or brine baths of Germany and other countries, to some extent take the place of sea baths in inland districts, and like sea baths are employed in scrofulous, rickety, and various cachectic conditions, requiring stimulant treatment.

Muriated baths, such as those of Kreuznach, Woodhall Spa, &c., have a reputation in chronic inflammatory conditions of the female pelvic organs. They promote the absorption of the products of previous inflammation (perimetritis, parametritis, &c.), and they often diminish the congestive troubles associated with fibromyomata of the uterus.

Natural brine wells vary¹ in strength; and besides common salt, contain, like sea water, smaller quantities of many other salts. (See Chapter XIII.) The stronger brines are often diluted with plain water for baths, and the weaker ones are artificially strengthened by the addition of a concentrated muriated water (‘gradirte Soole’), or of a ‘Mutterlauge,’² that is, the concentrated solution of salts—calcium chloride, &c.—left when most of the common salt has been made to crystallise out.

¹ The degree of saturation with common salt is actually or almost reached by brines like those of Droitwich, in England, and Rheinfelden, in Switzerland.

² The German term, ‘Mutterlauge’ (French ‘Eau-Mère,’ Italian ‘Acqua Madre’), has been generally used in preference to the English ‘Mother Lye’ or ‘Mother Water.’ The English terms are hardly ever employed; indeed, on reading a notice of Woodhall Spa, in England, we observed that the German word ‘Mutterlauge’ was used.

(See under Kreuznach.) The different 'Mutterlauges' vary considerably in the relative proportion of their constituents, amongst which, besides calcium chloride, are the remnant of common salt and the chlorides of magnesium, potassium, strontium, and lithium, likewise bromides, iodides, &c.

Some authorities, fearing to cause too much irritation, prefer comparatively weak brines to the stronger ones, but H. Keller, M. Mayer, and others, point out that strong brine baths, such as are in favour at Rheinfelden, Droitwich, Ischl, Salies-de-Béarn, &c., may be used with care in many cases for which brine baths are indicated, without any of the bad results of excessive stimulation being observed. The individual reaction of each patient to salt baths must, however, always be considered. Baltouzewitsch,¹ from his experiments on the metabolism, circulation &c. of healthy persons submitted to courses of muriated baths, comes to the conclusion that warm (95° F.) baths of moderate strength (3 per cent.) are preferable in feeble, exhausted, or excitable patients, whereas in over-fed persons with rheumatic complaints &c. more concentrated baths (9 per cent. or over) are best.

Muriated springs sometimes contain excess of free carbonic acid gas, and to the presence of this gas in the gaseous warm salt baths ('Thermal-Soolbäder') of Nauheim and Oeynhausien the mechanical stimulating effect of these baths is largely due. It is this effect which is made use of at Nauheim (*q.v.*) in the treatment of cardiac affections.

When taken internally, chloride waters of medium strength (cf. Chapter XIV) probably exercise a gently stimulating effect on the gastric and intestinal mucous membranes, increasing peristalsis and rendering the contents of the bowel more fluid. The direct stimulating effect on the gastric mucous membrane (see later) is doubtless increased by the large amount of carbonic acid gas present in some of these waters. The laxative action on the bowels varies much in different individuals. J. Felix finds that mineral waters containing sodium chloride (Châtel-Guyon) when poured into a vessel lined with uric acid, detach the uric acid and hold it in suspension, as if they acted by dissolving a mucous material which attached the uric acid to the sides of the vessel.

By increasing the digestive secretions (see later), or by some other power of facilitating the digestion of albuminous materials, they tend to increase the general nutrition. At any rate, unless they are taken in quantities which produce catarrh of the stomach and intestines, they do not cause emaciation, and by this circumstance differ greatly from the sulphated waters. We have, on

¹ *Annales d'Hydrologie*, November 1898, vol. iii. p. 513.

the contrary, often seen increase of weight in thin persons as well during as after well-arranged courses of muriated waters. Muriated waters are therefore, *cæteris paribus*, in spare or emaciated persons preferable to sulphated alkaline waters. Much of the apparent effect of all these waters on the general metabolism must, however, depend on the diet of the patient whilst undergoing the cure. (Cf. Chapter XXI.)

These waters are used in cases of anæmia where iron is badly borne, in cases of 'tropical' cachexia, and in convalescence from infectious diseases. It may be noted here that some gaseous muriated springs (e.g. at Homburg) contain a very fair amount of bicarbonate of iron.

The presence of iodides and bromides in some muriated waters, Wildegg in Switzerland, Adelheidsquelle at Heilbrunn, Woodhall Spa in England, Hall in Austria, Kreuznach &c., has been supposed by some to exercise a special alterative action in various cachectic conditions, and even in syphilitic affections, though the quantities of iodide which are taken in the form of mineral waters seem extremely small when compared with the doses given in ordinary medicines for the latter affection. (For the use, however, of muriated waters in syphilis, chiefly in the form of warm baths, see Part III, Chapter XXXII, under Syphilis.)

The waters of Llangammarch Wells, like some of the Harrogate waters (see Chapter XXV), contain a small amount of barium chloride (see Chapter XIV), a salt which is said to increase blood pressure and promote diuresis by exerting a tonic action on the walls of the small arteries, somewhat resembling that of supra-renal extract.

Owing partly to their diuretic and laxative effects, muriated waters are useful in relieving the abdominal circulation and removing engorgement of the liver and of the hæmorrhoidal vessels. In this way they may be serviceable in some cases of dyspepsia and gastric catarrh, especially in older persons, in hæmorrhoids, in chronic uterine complaints, and in certain cases of chronic headache. C. von Noorden ('Practitioner,' 1896) maintains that in addition to their action in cases associated with constipation these waters may sometimes be useful in apparently opposite conditions (i.e. passage of much mucus). The calcium salts in certain muriated waters (Rakoczy spring at Kissingen) might have a beneficial effect in some chronic headaches (cf. p. 735).

Adolf Bickel ('Berliner klinische Wochenschrift,' 1906, No. 2) has been able to study the direct action of various mineral waters on the gastric secretions (1) by observations on animals in which, after Pawlow's method, a portion of the fundus of the stomach had been separated from the main part of the stomach and made

into a blind pouch with an opening in the abdominal wall, so that animals thus operated on possessed, in addition to an ordinary stomach, a 'lesser stomach,' separated from the main stomach, and opening externally by a gastric fistula; (2) by observations on animals with an artificial gastric fistula, in which, by means of another operation, the lower end of the œsophagus had been made to open externally instead of into the stomach, so that Pawlow's 'Scheinfütterung' experiments could be carried out, all that the animal swallowed falling out of the œsophageal fistula instead of entering the stomach; (3) by observations on a patient aged twenty-three years, in whom, on account of a cicatricial stricture of the œsophagus, a gastric fistula had to be made, and on whom, for therapeutic purposes, Professor Gluck had by another operation made the œsophagus to open externally so as exactly to reproduce the condition present in Pawlow's dogs used for the 'Scheinfütterung' experiments.

By these means Bickel was able to carry out a series of experiments remarkable for their simplicity. He found that simple gaseous waters (Apollinaris, Giesshübl), muriated waters (Rakoczy spring of Kissingen, Wiesbaden Kochbrunnen), and muriated alkaline waters (Ems, Selters), all of them, as compared to distilled water and ordinary tap water, rather increased than decreased the specific secretory activity of the gastric mucous membrane, whereas simple alkaline waters (Vichy) and sulphated alkaline waters (Karlsbad) had a slight tendency to diminish, and the sulphated 'bitter' waters (Hunyadi Janos water) decidedly diminished the gastric secretory activity, although 'bitter' waters sometimes induced a watery flow from the gastric mucosa, which increased the fluid contents of the stomach. In these experiments the acid contents, as well as the total amount, of gastric juice were considered, and Bickel concludes that in organic gastric disorders accompanied by excessive secretion and excessive hydrochloric acidity the simple alkaline and sulphated alkaline waters are to be preferred to the muriated waters, &c.; whereas in conditions of subacidity supervening on chronic gastric catarrh and other organic diseases of the stomach, the indication is rather for simple gaseous waters, muriated waters, or muriated alkaline waters (waters of the two last classes are of course often likewise gaseous). In neurasthenics with hyperacidity, however, the exact kind of mineral water selected may be less important.

According to C. Dapper and C. von Noorden, muriated waters, such as those of Homburg, Kissingen, &c., can be of service in certain gastric disturbances associated with hydrochloric hyperacidity, as well as those associated with subacidity. Such a

beneficial action in contrary conditions points, we think, to the effect on the digestive organs being in great part an indirect one, secondary to improvement of the general health and to strengthening of the nervous system. Noorden recommends these waters when the hyperacidity occurs in young men with gastric neurasthenia and gastric hyperæsthesia, and with a consequent dread of taking food freely.

Muriated waters are not recommended in the hyperacidity accompanying chlorosis or ulcer of the stomach, but Dapper ('Berliner klin. Wochenschrift,' 1899, No. 39) believes that they are of great use when the hyperacidity forms part of a neurasthenic disturbance, and when it occurs in the so-called 'acid dyspepsia' with atony (resulting from dietetic errors). In contradiction to some older opinions he finds that fat can be made good use of by patients when undergoing a course of muriated waters. In gastric hyperacidity fat has apparently an influence in lessening the excessive acidity,¹ and Dapper has obtained good results in some such cases by giving considerable quantities of fat during the mineral water treatment. In hypopeptic cases mineral water treatment helps to augment the gastric secretion. F. Unger's results ('Deut. med. Wochenschr.' 1898, No. 23), obtained by Winter's methods of investigation, show that in such cases the increased secretion of hydrochloric acid accompanying the treatment is more noticeable in regard to the acid combined with albuminous matter than in the free HCl. In nervous and other hyperacid and hyperpeptic conditions Unger found that the mineral water treatment exercised a more beneficial effect on the gastric secretion when the combined HCl was relatively in excess than when the hyperacidity was due chiefly to excess of free HCl.

The *combined external and internal* use of muriated waters is serviceable in tendencies to catarrh of the gastric, intestinal, and respiratory mucous membranes. In these cases the skin is 'strengthened' and becomes less sensible to winds and draughts and to slight changes in the temperature and moisture of the air. In bronchitis the waters may be inhaled (see Chapter XIV),

¹ According to Professor J. P. Pawlow's experiments on dogs (see A. Walther's German edition of Pawlow's work, *Die Arbeit der Verdauungsdrüsen*, Wiesbaden, 1898, p. 136), fat exerts a decidedly inhibitory action on the gastric secretion. See also 'Untersuchungen über die Diät bei Hyperacidität,' by H. Strauss and L. Aldor, in *Zeitschrift für diätetische und physikalische Therapie*, Leipzig, 1898, vol. i. In gastric hypersecretion and hydrochloric hyperacidity, Max Buch ('Experimenteller Beitrag zur Diät bei Hyper- und Hypochlorhydrie,' *Zeitschr. f. diät. u. phys. Therapie*, 1900, vol. iv.) decidedly confirms the conclusion that fats and oils have a real inhibitory action on the gastric secretion. They are only contraindicated in exceptional cases—that is, when the symptoms complained of are aggravated by their use. Good butter is the form of fat generally to be preferred.

and make the secretion of the bronchial tubes less viscid, promoting expectoration. In emphysema and chronic bronchitis the good results of the 'Thermal-Soolbäder' are probably partly due to their effect on the heart's action and general circulation.

The occasional occurrence of acute attacks of gout when gouty patients commence a course at Wiesbaden &c. can hardly be attributed to the sodium chloride contained in the water, since thermal baths of other groups may likewise cause temporary exacerbation of the malady.

For use in rheumatoid arthritis, sciatica, and gouty and rheumatic neuritis cases, the hotter springs (i.e. external use of) are more beneficial.

The muriated sulphated waters of Brides-les-Bains, Leamington, Cheltenham &c. are in their action somewhat akin to members of this group. (See Chapter XXII.) In the present group, Droitwich, Nauheim, Kreuznach, Homburg, Kissingen, Wiesbaden, and Baden-Baden have been placed first, as being at present amongst the best known and most representative spas; they have been somewhat more fully discussed than the other members of the group, which are arranged in the geographical political order adopted in the previous chapter. In the following account the waters used externally are not separated from those chiefly used internally, but the reader will, we believe, at once see from our description whether any water in question belongs chiefly to the subdivision for external use (like Droitwich) or to that for internal use (like many of the gaseous springs of Homburg and Kissingen).

Droitwich (England, Worcestershire).—Droitwich, in England, like Rheinfelden, in Switzerland, possesses a brine which may practically be regarded as a saturated solution of common salt,¹ and which may be taken as a type of the strongest brines (German, 'Soolen'). According to the analyses, the Droitwich brine contains 31 per cent. of common salt, that is, about ten times as much as sea water; it contains likewise about 5 per mille sulphate of sodium, and 1·3 per mille sulphate of calcium.

¹ A. E. Garrod found the specific gravity of a specimen of Droitwich brine to be 1·195. The specific gravity of Rheinfelden brine is 1·205 according to Bolley. The 'Big Rapids' American Water, Michigan, U.S.A., advertised as being 'the strongest natural medicinal water known,' according to the *Lancet* (January 4, 1896, p. 40), has a total mineralisation of 33·8 per cent. and contains, in addition to common salt, some calcium chloride, magnesium chloride, and bromide of sodium. All such waters are practically saturated solutions; and with them may be compared the waters of certain inland seas and lakes which have no outlet. Thus, owing to constant evaporation, the waters of the Utah Salt Lake contain about 22 per cent. of salts in solution, the Dead Sea about 24 per cent., and the Tuz Gul Lake, in the centre of Asia Minor, 32 per cent.; indeed, some such lakes have at last dried up altogether, leaving a solid saline deposit to mark their former positions.

It is impossible to sink in such water unless a weight be attached to the body.

The country is very pleasant, though the old town is not beautiful. Owing to the dissolving process which at Droitwich, as at Northwich, in Cheshire, perpetually goes on in the underlying salt beds, buildings gradually sink, and the level of the ground at certain spots is changing.

Ordinary methods of heating such concentrated brine cause, owing to evaporation, a partial precipitation of the salt. The water has therefore to be heated by steam or by the addition of hot water before being used for bathing purposes. The time of immersion in the warm baths is about twenty minutes; they are usually given at a temperature of 98° to 101° F. They are employed in muscular rheumatism, sciatica, and in chronic rheumatic and gouty affections, and exert a tonic effect in convalescence from acute illnesses. The treatment may sometimes in gouty patients provoke an acute attack of gout, a fact which is occasionally observed at many other spas. The brine is likewise employed for swimming baths.

The undiluted water if taken internally exercises a very disagreeable irritative and purgative effect.

The baths are open all the year round, but the summer months are preferred for treatment. The hotel accommodation is good.

Nauheim, Bad-Nauheim (Germany, Grand Duchy of Hesse). Nauheim lies at an altitude of about 400 feet, on fairly level ground, to the east of the Johannisberg, a projecting spur of the Taunus range. The value of Nauheim as a spa was first made generally known in 1859 by the late Professor Beneke, but it was owing to the writings of the brothers Schott that the spa afterwards became so well known in England and other countries.

The different springs at Nauheim vary much in their balneotherapeutic qualities; four are used for drinking, and others for baths. The two used chiefly for drinking are the Kur-Brunnen and the Karls-Brunnen, which have lukewarm waters containing about 1 to 1½ per cent. common salt, 1 per mille chloride of calcium, and are effervescent with free carbonic acid gas. The Ludwigs-Brunnen (Grosskarben) is a weakly mineralised muriated alkaline gaseous water, useful as a table water, especially in dyspeptic troubles, or for diluting the two former waters. The fourth spring, the Schwalheimer-Brunnen (1·3 per mille common salt, 0·13 earthy bicarbonates, 0·01 bicarbonate of iron), within easy reach of Nauheim, supplies a cold slightly chalybeate gaseous water, which may be used as a table water, especially in anæmic cases. Both these waters are sold in bottles in all the hotels and pensions of the town.

The waters used for the baths contain about 2. to 3 per cent. chloride of sodium, 2 to 3 per mille chloride of calcium, some bicarbonate of iron, and much carbonic acid gas. The temperature of the waters is 82° to 95.5° F. Two of these springs rise in jets from the ground, and hence have been named respectively the Great and the Little Sprudel; they are rich in carbonic acid gas, one of them containing 1,340 cubic centimetres to the litre of water. The radio-activity of the Nauheim spring-deposits is very considerable according to Elster and Geitel.

Different kinds of baths are given: a simple salt bath, the carbonic acid gas having been allowed to partially or nearly completely escape [these baths may be given at different temperatures, and strengthened, if necessary, by the addition of 'Mutterlauge']; an effervescent bath (the Sprudel bath); and an effervescent wave or surf bath (the 'Sprudelstrom' bath). The latter (a speciality of Nauheim) is the most stimulating; the Sprudel water used for it is conducted direct from the spring into the bath.

There is a separate bath-house for the simple salt baths. Besides the baths there are rooms for inhaling the waters and 'Gradirhäuser,' near which the patients can sit, as at Kreuznach, Kissingen, Reichenhall, &c.

A great many different affections can be treated at Nauheim. Scrofulous and rachitic children, convalescents, patients with functional nervous disorders, those with chronic catarrhal affections of the respiratory and alimentary tracts, are treated here as at other common salt water spas. In neuralgic affections the hotter baths are preferable. The gynaecological affections likely to be benefited by salt baths can of course be treated at Nauheim. Bronchitic patients may inhale the waters or sit by the 'Gradirhäuser.'

In disorders of the digestive system, drinking the water of the Karls-Brunnen plays a similar part to drinking that of the Elisabethen-Brunnen, in Homburg. When the undiluted water of the Kur-Brunnen is likely to cause too much irritation, it may be diluted, preferably with the Ludwigs-Brunnen, according to Beneke's plan, and then is said to resemble the water of the Rakoczy spring in Kissingen.¹ The muriated waters are usually taken before breakfast, either diluted or undiluted, in amounts of from 5 to 30 ounces. The Schwalheimer-Brunnen and Ludwigs-Brunnen may be taken later in the day, and form agreeable table waters.

In lingering results of acute or sub-acute rheumatism, the various baths are useful in promoting absorption of the remain-

¹ Patients, however, themselves have stated that they have found the action quite different.

ing products of exudation in the joints, and, according at least to Beneke's view (1872), in promoting absorption of the lymph from the affected cardiac valves. By their general tonic action on the system they probably also help in counteracting any tendency to relapse.

The stimulating effect of the Nauheim 'Sprudel' baths on the circulation enables them to be given at a lower temperature than ordinary baths: ¹ this effect is due to a reflex action from the skin, which is stimulated by the combined action of the salts, the bubbles of carbonic acid gas, and, in the case of the 'Sprudelstrom' bath, by the movement of the water. The salt water soaks through the superficial layers of the epidermis, and acts as a chemical irritant to the nerve-endings in the skin, whilst the carbonic acid gas and the movement of the water act as mechanical stimulants.

It is indeed to the treatment of disorders of the heart and circulation, as systematically elaborated on Beneke's lines by the Brothers Schott, that Nauheim owes much of its present reputation. According to this method, the baths are often employed in conjunction with gymnastic exercises, and by prolonged courses of the treatment (somewhat resembling digitalis in its effects) subcutaneous oedema and chronic effusions into the peritoneum and pleuræ, apparently *partly* due to imperfect action of the heart, have been successfully treated.² The heart's action gains in strength and regularity, whilst the oedema and other signs of imperfect action gradually disappear.

Care is necessary in beginning the baths. Dr. Theodore Schott says it is advisable to begin with 1 per cent. salt baths free from carbonic acid, and at a temperature of 92° to 95° F., the baths lasting six to eight minutes, and being followed by rest. They should be omitted for a day at frequent intervals. The temperature at which the baths are taken may be reduced gradually, from day to day, until 85·5° F. in suitable cases is reached, whereas the proportion of the solids they contain and the time of immersion are slowly increased. Later on in the cure the 'Sprudel' bath may be commenced, and finally the still more stimulating 'Sprudelstrom' bath. The whole course should last six weeks or more.

The exercises devised by the Brothers Schott³ form a system

¹ The term 'Thermal-Soolbäder,' applied to Nauheim and Oeynhausén, simply means warm common salt baths, but is usually taken to imply also that the water is rich in carbonic acid gas.

² The danger of removal must, however, be considered.

³ For a careful account of the different movements see W. Bezy Thorne, *The Schott Methods of the Treatment of Chronic Diseases of the Heart* (fourth edition,

of 'voluntary movements with resistance,' similar to P. H. Ling's Swedish system of 'Widerstands-gymnastik,' but differing from the exercises in which Dr. Zander's 'medico-mechanical' appliances (those used for voluntary movements) are necessary, by the fact that the 'Widerstand' or resistance is supplied, not by the weight attached to a lever or pulley, but by the hand of the doctor or skilled attendant supervising the exercise. In dilated hearts the immediate result of about ten minutes' exercise is often a diminution in the superficial area of cardiac dulness. This diminution does not last, and it would be out of place here to discuss its therapeutic significance,¹ but what is much more important is the satisfactory result which often follows a prolonged course of the treatment in suitable cases of the class mentioned above. There appears to be considerable danger, however, of patients with heart disease and insufficient compensation of such a severe character that treatment at home in bed is absolutely necessary, being injudiciously recommended to try the Nauheim treatment.

The consideration of the mode of action of the baths and exercises opens up very difficult questions. That temporarily the heart's action is reflexly strengthened by both the baths and exercises (if the 'dosage' be correctly estimated²), there can be

London, 1902); see also A. Morison, *Cardiac Failure and its Treatment, with especial Reference to the Use of Baths and Exercises* (London, 1897).

¹ Dr. Theodore Schott soon after the introduction of Roentgen rays endeavoured by their help to demonstrate changes in the size of the heart resulting from Nauheim baths and exercises. (See *Deutsche med. Wochenschr.* 1897, No. 14.) M. Heitler believes that spontaneous variations sometimes occur in the dulness of normal hearts. (See 'Die Percussionsverhältnisse am normalen Herzen,' *Wiener klin. Woch.* 1890, p. 787.) B. A. Abrams ('The Clinical Value of the Heart Reflex,' *Medical Record*, New York, 1901, vol. lix. p. 10) and P. Merklen and J. Heitz ('Le Réflexe Cardiaque d'Abrams, Ses Applications au Diagnostic et au Traitement,' *Bull. de la Soc. Méd. des Hôpitaux de Paris*, July 1903, No. 28, p. 905) find that the area of cardiac dulness can in most persons be reflexly diminished by stimulation of various parts of the body, especially the præcordium. A. Mougeot ('De la réduction par le bain carbogazeux du volume du cœur dilaté,' *Archives générales de Médecine*, Paris, 1905, No. 27) thinks that the diminution of the cardiac dulness effected by gaseous baths is almost confined to the right side of the heart and that it may have a diagnostic significance; the failure of the baths to reduce the size of a dilated heart would, according to Mougeot, point to advanced myocardial changes or pericardial and mediastinal adhesions. As far as we know, however, the sudden alterations in the size of the heart which have been claimed to result from baths or from stimulation of various parts of the body have not yet been thoroughly confirmed by modern orthodiagnostic, or rather orthodiagraphic, methods.

² Dr. W. Bezly Thorne (*Journal of Balneology*, July 1898, p. 246) explains this point very strikingly: the difference in methods between the person who goes into a thermal bath at Nauheim and the man who bathes in the Serpentine in Hyde Park on a cold January morning is one of degree, not of kind. In both cases the surface of the body is subjected to a cooler medium which promotes reaction. The question is one of the relative powers of reaction in different individuals. On the 'dosage' of gymnastic movements in heart affections see also Dr. A. Morison's book on *Cardiac Failure* (1897), p. 168.

little doubt; moreover, the chambers of the heart must be relieved, and the total circulation favoured, by the derivation of blood from the deep organs to the skin and muscles, and by the great increase in the blood-flow through the muscles consequent on exercise. In the first place, it may be pointed out that any, even temporary, improvement in the action of the heart leads not only to a better circulation in the body generally, but also in the heart itself. Severe coronary artery disease must, on the other hand, necessarily be an insuperable obstacle to a favourable result. In the second place, we may remember that in most cases of deficiency in the heart's driving power (with or without mechanical defect by valvular disease) there are other factors as well which help to bring about the general morbid condition of the patient. The kidneys and skin may not be acting properly, and there may be disorders of the digestive system, all of which may interfere with the general nutrition of the body, and of the heart, as well as of the other organs. The careful use of the baths and exercises may help in removing these troubles, and so indirectly as well as directly act favourably upon the nutrition of the heart, and of the body generally.

According to Sir W. and Dr. J. F. H. Broadbent ('Heart Disease,' London, 1897, pp. 94, 95), the results of the Nauheim treatment may be very good in cardiac disturbance from temporary loss of tone after influenza and depressing illnesses, and also in many functional and neurotic complaints. In valvular disease, when compensation has completely broken down, rest in bed and suitable treatment by other means are likely to be more efficacious. In mitral disease, especially mitral stenosis, when compensation is just maintained with difficulty, it may, these authors think, be of great service; and though in ordinary aortic disease this method of treatment (like *digitalis*) is not advisable, yet when mitral symptoms supervene, it may (like *digitalis*) sometimes be of use.

Dr. Alexander Morison ('Journal of Balneology,' April 1906, p. 72), who specially insists on the importance of not sending any patients to Nauheim who cannot safely travel, groups cardiac cases which he considers suitable for treatment at Nauheim as follows: 'Those which have not passed the meridian of life, and have a weakness of myocardium, moderate in degree, with or without irregularity of action, and without organic valvular lesion, or organic disease of other organs, and which especially are free from essential disease of the kidneys. (2) A similar degree of disordered action of the myocardium, with organic valvular disease, other than aortic reflux and the rarer organic diseases of the right side of the heart, with the exception of

milder forms of congenital cardiac malformation, and which, so far as we can determine (for this point is often difficult), are free from extra-cardial adhesion. (3) Older patients with myocardial debility, without pronounced arterio-sclerosis, without organic valvular disease, without disease of organs other than the heart, and without the symptoms of "angina vera," to use a convenient but not strictly accurate term.'

The baths and exercises need not necessarily be used together. In certain cases the baths appear to act favourably, whilst the exercises do no good (see Dr. W. A. Sturge, 'British Medical Journal,' 1895, vol. i. p. 527, and the paper by Dr. R. Saundby, 'British Medical Journal,' 1895, vol. ii. p. 1081); in other cases exercises act best. This may partly be a question of 'dosage.'

At the end of a course of Nauheim treatment, and in order to further the beneficial result, the local doctors can make use of carefully graduated climbing exercise, for which there are facilities in the neighbouring footpaths.

Dr. Siegfried employs graduated cycling exercises in certain cases. For this purpose he has introduced a tricycle, the treadles of which can be adjusted to revolve in smaller or larger circuits so as to meet the special requirements of individual cases. When pushed along by an attendant the tricycle serves as a machine for passive movements of the lower extremities.

The Nauheim season lasts from May to the end of September. The accommodation is good. There are besides hotels and boarding houses sanatoria where diet &c. are under personal medical supervision.

Kreuznach (Germany, Rhenish Prussia).—Kreuznach (altitude 340 feet) lies on both banks of the Nahe, about 10 miles from its entrance into the Rhine. The town proper is somewhat cramped and old-fashioned, and its drainage arrangements are said not to be quite satisfactory, but Bad-Kreuznach has roomy streets and villas. The latter constitutes the south-western portion of the town, lying partly on an island, partly on the right bank of the river, at the commencement of the narrower portion of the Nahe Valley: it has a special railway station of its own, and patients may avoid the old town as much as they like. About a mile and a half southwards up the Nahe, in the narrower part of the valley, lies the village of MÜNSTER-AM-STEIN (altitude 380 feet), with similar mineral springs to those of Kreuznach, but hotter. The bold porphyry cliffs of Rothenfels and Rheingrafenstein, with the ruins of Sickingen's Castle of Ebernburg, and that of the Rheingrafen, make the scenery towards Münster-am-Stein very striking. The climate of Kreuznach is extremely mild; too hot for some persons in the height of summer. The

hill-slopes in the neighbourhood are mostly vineyards, and do not afford the shady walks which might be desired for patients; one has to walk some distance on to the hills to reach woods which offer protection from the sun; shade amongst the trees may, however, be obtained in the Kurgarten.

The waters of Kreuznach contain about 10 per mille common salt and about 2 per mille chloride of calcium, together with minute quantities of chlorides of strontium, barium, &c., bromide and iodide of sodium, traces of arsenic, &c.; the latter constituents probably not being present in sufficient quantity to exercise any special therapeutic effect. The Kreuznach waters have been found to possess decidedly radio-active properties; moreover the sediment from the springs has been shown to contain radium and also thorium compounds, and radio-activity can by means of this sediment be transferred from the Kreuznach water to inactive distilled water.¹ The springs are numerous, but the cold Elisabethquelle (10 per mille common salt and 1.9 per mille chloride of calcium, according to the 1894 analysis by R. and H. Fresenius) is the spring chiefly used for drinking, and in the cold water the salt taste is not so disagreeable to the palate as it would be in the case of tepid springs. Two or three glasses are drunk, by preference on an empty stomach before breakfast, but naturally the dose varies according to the age and complaint of the patient. The baths are warmed to the required temperature, and usually strengthened by the addition of 'Mutterlauge,' that is, a strong solution of salts left when most of the common salt of the Kreuznach water has been made to crystallise out: the Kreuznach 'Mutterlauge' contains about 20 per cent. of chloride of calcium. Owing to the action of the 'Mutterlauge' on stone and porcelain, wooden tubs have to be employed for the baths. The supply of mineral water is so great that all the hotels and most of the houses are supplied with it.

In the Kurhaus are excellent newly built hot air and vapour baths, with arrangements for douches and massage; there is likewise an inhalation room, in which the air is charged by the Wassmuth method with the very finely pulverised mineral water, and where patients recommended to inhale the water may sit dressed in their ordinary clothes, protected by a loose outer oil cloth. Between Kreuznach and Münster-am-Stein are many 'Gradirhäuser,' where patients may sit on the side away from the

¹ 'Untersuchungen über die Radioaktivität der Kreuznacher Solquellen,' by Dr. K. Aschoff, *Zeitschrift für öffentliche Chemie*, 1905; and Aschoff, 'Das Vorkommen von Radium in den Kreuznacher Solquellen,' *Münchener med. Wochenschrift*, March 14, 1905, p. 517. In regard to the radio-activity of the sediment, compare the remarks in the sections on Wiesbaden and Baden-Baden.

wind; these 'Gradirhäuser' are high fences formed by bundles of twigs, through which the water is made to drip so as to concentrate it as a preliminary to heating it over a fire in the process of obtaining common salt and 'Mutterlauge;' as the water drips, the impetus of the falling drops and any wind there happens to be, carry fine particles of the water into the surrounding air, which are inhaled by patients seated in the immediate neighbourhood, just as fine particles from the spray of sea water are inhaled during rough weather at the sea-shore.

Amongst the affections treated at Kreuznach the various forms of scrofula and rickets take the chief place. The Victoria Hospital is a charitable institution, where during the year about six hundred poor scrofulous and other children can stay for about four weeks, and besides the baths can receive operative and other treatment if necessary. It resembles (except in climate) seaside children's sanatoria, such as those at Margate, in England, Norderney, in Germany, and Berck-sur-Mer, in France.

Many patients come to Kreuznach for chronic catarrh or tendency to catarrh of the throat, nose, larynx, and bronchi. In this class of cases the inhalation room can be used, and the mild climate must help greatly in the results obtained, though higher altitudes are often preferable. Syphilis and chronic cutaneous affections are treated at Kreuznach as they are at many other continental spas. (See under Aachen, in Chapter XXV.)

The spa is resorted to for chronic catarrhal and other chronic inflammatory conditions of the female generative organs and the remnants of pelvic cellulitis. It is not seriously maintained at present that the spa-treatment has power to produce absorption of fibroid or other tumours of the uterus, though doubtless it may diminish the troubles connected with swelling and inflammatory changes around them; in gynæcological complaints as well as in other complaints treated at Kreuznach, the physicians are ready to aid the action of the waters by ordinary well-recognised methods of treatment. The hot air and vapour baths are useful in the class of cases usually treated by such means. The season lasts from May 1 to the end of September. The hotel accommodation is good.

Homburg, Homburg-vor-der-Höhe (Germany, Prussian Province of Hesse-Nassau).—Homburg lies at an altitude of about 600 feet, in a rather exposed position on the summit of an elevation to the south of the Taunus range. Owing to its open position the air is 'fresh.' The throng of visitors who resort to Homburg as a place of amusement and fashionable society cause its character as a health resort to be somewhat modified.

The springs are comparatively cold; those used for drinking

are the Elisabethen-Brunnen, the Kaiser-Brunnen, the Ludwig-Brunnen, the Landgrafen-Brunnen, the Luisen-Brunnen, and the Stahl-Brunnen, all of which are rich in carbonic acid gas. The Elisabethen-Brunnen, the one most generally used, contains about 1 per cent. of common salt. The newly discovered Landgrafen-Brunnen, besides about 1 per cent. common salt, is said to contain 2 per mille calcium chloride and 1 per mille magnesium bicarbonate and 0.08 per mille bicarbonate of iron. The Luisen-Brunnen and the Stahl-Brunnen are muriated chalybeate springs. The Stahl-Brunnen is the richer of the two in iron (about 5 per mille common salt, 1 per mille bicarbonate of calcium, and 0.09 per mille bicarbonate of iron), and is compared to the Wein-Brunnen at Schwalbach; both the Stahl-Brunnen and the Luisen-Brunnen smell slightly of sulphuretted hydrogen, like the Pouhon of Peter the Great at Spa. The Sool-Sprudel, which contains about 20 per mille common salt and about 1,500 ccm. carbonic acid gas in the litre, is admirably adapted for effervescent baths.

Amongst the patients treated at Homburg are many with chronic gouty and rheumatic affections and the 'uric acid diathesis;' many suffering from habitual constipation; patients who have been accustomed to eat and drink too freely, but for whom the alkaline sulphated waters of Karlsbad and Marienbad are thought to be too strong; patients with chronic catarrhal affections of the alimentary and respiratory tracts. Troublesome cases of chronic headache are sometimes relieved. For overworked persons and excitable patients with functional nervous affections, quieter spas are often to be preferred.

The iron springs of Homburg are employed for anæmic and debilitated patients, either alone or in conjunction with the ordinary muriated waters; they may be conveniently taken after meals, whilst the muriated waters are taken, when possible, on a fasting stomach before breakfast. Such matters, however, must be specially ordered by the local medical man to suit individual cases.

In regard to baths, those now used are of metal so arranged that the water can be heated from a steam chamber at the bottom with the least possible escape of carbonic acid gas. The 'Nauheim' treatment (*q.v.*) for cardiac disorders can be employed owing to the richness of the Homburg waters in CO_2 . There are special rooms for inhalation treatment. Homburg possesses likewise well-known establishments for Swedish gymnastics, massage, electrical treatment, &c.

Amongst the pleasant excursions which can be made from Homburg is the particularly interesting and, owing to the electric

tramway, easy one to the Roman fortress of the Saalburg, about four miles distant. For those who can take active exercise there are the beautiful forest paths to the summits of the Altkönig, Kleiner Feldberg and Grosser Feldberg, the last-mentioned being the highest point (2,900 feet) in the Taunus. The Homburg season is from May to the end of September.

Kissingen (Bavaria).—Kissingen is beautifully situated in the fairly open valley of the Fränkische Saale, at an elevation of about 650 feet above the sea-level. It is surrounded by wooded hills, where the so-called 'Terrain-Cur' can be taken, consisting in graduated gentle uphill and downhill exercise. The climate is that of Central Germany.

Of the springs used for drinking, the most important is the Rakoczy-Quelle, which yields a cold effervescent water, containing about 6 per mille common salt and small quantities of the chlorides of potassium, lithium, and magnesium, and of the carbonates of iron (0.03 per mille) and calcium (1 per mille). The Pandur-Quelle is similar to the Rakoczy, but slightly weaker. The Max-Brunnen yields a pleasant, weakly mineralised, cold, effervescent water. All these three springs arise close together in the Kurgarten. The Rakoczy and Pandur waters, when a greater laxative effect is required, are recommended to be mixed with a product termed 'Kissingen bitter water,' obtained, according to a method of Liebig, from the 'Soole' springs.¹ In catarrh of the stomach and bowels the water is warmed before drinking, though most of the carbonic acid gas escapes during the warming process.

The usual time for drinking the waters is the morning before breakfast between 7 and 9 o'clock, but a second dose is sometimes taken in the afternoon. Water from the neighbouring spa of Bocklet (Chapter XXIII) is brought to Kissingen fresh every day, and may be given in cases when, owing to anæmia, a chalybeate water is considered suitable in addition to Kissingen water; it is usually taken later in the day than the Rakoczy and Pandur waters. The Max-Brunnen water is sometimes used merely as an agreeable aerated draught at various times of the day.

There are three bath-houses, two in the town and one in the valley close to the 'Gradirhäuser,' about 1½ miles to the north of the town; to the latter a small steamboat runs during the season. The springs chiefly used to supply the baths are the Salinen-Sprudel (Sool-Sprudel), close to the 'Gradirhäuser,' and

¹ By 'cryoscopic' examination the osmotic pressure of this Kissingen bitter water is found to be very high, so that it ought to have a decidedly purgative effect. The depression of its freezing point is said to be 1.11° C., whilst that in the case of Hunyadi Janos water is 1.047° C., and Apenta water 1.015° C.

the Schönborn-Sprudel (11·7 per mille common salt, very rich in CO_2), further off, at the village of Klosterhausen; the Pandur-Quelle is also used for baths.

Different kinds of baths can be supplied: firstly, ordinary Soolbäder at different temperatures; secondly, Soolbäder rendered more stimulating by the addition of Kissingen 'Mutterlauge'; thirdly, 'Wellenbäder.' Great improvements have been effected in the method of heating the water of the baths so as to lessen the escape of carbonic acid gas. The waves of the 'Wellenbäder' are caused by a jet of water forced in through a hole in the bottom of the bath when the tap is turned on; with these baths are likewise provided a douche of Soole water and a shower bath of plain water. Mud baths and ordinary douches may likewise be obtained.

Carbonic acid gas collected from the water is employed to supply carbonic acid gas baths, the application of the carbonic acid atmosphere being, of course, confined to the body, so that very little, if any, can be inhaled.¹ There are likewise rooms for inhaling the waters in the form of a very fine spray; the inhalation is employed in the case of patients suffering from catarrh of the respiratory organs, and such patients may likewise inhale the air near the 'Gradirhäuser.'

Patients are treated for various complaints at Kissingen; there are those suffering from hæmorrhoids and constipation, those with catarrhal conditions of the stomach or bowels (with or without a tendency to diarrhœa), gouty and rheumatic affections, and also functional nervous disorders, especially those supervening on an anæmic or scrofulous basis. The hot baths and hot mud baths are useful in neuralgic pains. Massage can be employed in suitable cases. In some cases of anæmia, especially those with tendency to constipation, the waters of the Rakoczy spring appear to act more beneficially than iron in the form of medicines or in the stronger iron waters. Anæmic conditions with enlarged spleen after malaria are sometimes improved. Patients with chronic headache often derive benefit from Kissingen (cf. p. 735).

Some chronic skin eruptions are benefited by the baths, and the same class of gynæcological affections are treated as at other muriated springs; in these cases local treatment is, of course, often necessary, in addition to the balneotherapeutic treatment. Poor scrofulous children are cared for at a charitable institution of the town. Bronchitic affections have been already referred to. In the treatment of glycosuria, obesity, the 'uric acid diathesis,' and the less serious forms of renal disease occasionally sent to Kissingen, the diet has, of course, to be regulated, and in such

¹ See the section on gas baths in Chapter XIV.

cases it is sometimes an advantage if the patient can be treated, not in an hotel, but at an institution under the direct care of a resident physician. For such sanatorium treatment there are facilities at Kissingen.

Baths of 86° F. can be given retaining sufficient free carbonic acid gas to be used in cardiac cases, as Leusser pointed out, like the Thermal-Soolbäder of Nauheim (q.v.).

The season lasts from May to the end of September. Patients are often sent for an 'after-cure' to a climatic resort. For suitable localities in different classes of cases, the reader is referred to Chapter XXVIII.

Wiesbaden (Germany, Russian Province of Hesse-Nassau).—Wiesbaden (altitude 380 feet), formerly the capital of the Duchy of Nassau, is a beautiful town with handsome public buildings and private villas, and well laid-out grounds, where patients and visitors can promenade. It is protected on the north by the Taunus range, and the climate is fairly mild. Though in the midst of summer the heat is very great, there are numberless shady walks to be enjoyed in the woods of the neighbouring Taunus Mountains. These woods are carefully kept up, less for profit than for the recreation of the inhabitants and visitors of the neighbourhood. A funicular railway up the Neroberg (725 feet), whence a beautiful view is obtained over the surrounding country and distant hills, carries one at once right into the Taunus forest.

The waters of Wiesbaden were known to the Romans, and were described by Pliny as the 'Fontes Mattiaci';¹ they are thermal common salt waters containing about 5 to 7 per mille of common salt. Their temperature varies from 100° to 156° F. The 'Kochbrunnen'² is the hottest spring, and the one probably most used for drinking. Other springs used for drinking are the Wilhelmsquelle, the Adlerquelle, and the Schützenhofquelle. About twenty-four different springs are used for baths; the supply is abundant, and many of the hotels have their own spring and baths. A thin ochreous scum settles on the surface of the water when allowed to stand, and occasionally there is the very faintest smell of sulphuretted hydrogen. F. Henrich proved the presence of radio-activity in the gas, in the water, and in the sediment of

¹ Fontes Mattiaci or Aquæ Mattiacæ (Wiesbaden) was one of the chief towns of the German tribe of Mattiaci, another of whose towns was Mattiacum, the present city of Marburg.

² The water sold in bottles as 'Wiesbadener Gichtwasser' is a preparation made from the water of the Kochbrunnen, the main difference being an addition of about 8 per mille bicarbonate of sodium in the former. The preparation has been most strongly recommended by Dr. Carl Mordhorst for the treatment of chronic rheumatism and gout. The Wiesbaden Kochbrunnen has been used in many experiments on the physiological action of muriated mineral waters when taken internally.

the Kochbrunnen of Wiesbaden, and found that the deposit from the spring was not only strongly radio-active, but that it retained its radio-activity to a very considerable degree.¹

Perhaps chief amongst the patients treated at Wiesbaden come those with chronic (atonic) gout and rheumatism. Chronic catarrh of the larynx and bronchi is likewise often treated at Wiesbaden; inhalation chambers are provided for these cases. Some kinds of dyspepsia and chronic diarrhoea derive much benefit from drinking the waters. Chronic inflammatory conditions of the female generative organs are treated by baths as at Kreuznach. Syphilis is made a medical speciality of after the example of Aachen. At the new 'Augusta Victoria Bad,' besides the ordinary baths, there are elaborate arrangements for hot air and vapour baths, douches, compressed air baths (for pulmonary emphysema, &c.), ordinary massage, massage in hot baths, massage under hot douches (somewhat as in the Aix douche-massage), Swedish gymnastics and electrical treatment, which can be employed in suitable cases. There is at Wiesbaden likewise an institution for the treatment of disorders of motility by various methods, including the exercises after the method of Frenkel, of Heiden, for incoordination in tabes dorsalis.

Frankfurt, Mainz, and the spas of Schwalbach and Schlangenbad can easily be reached; the amusements of visitors are well looked after; and it is no wonder that Wiesbaden is thronged with patients and visitors. The spa is open throughout the year, but the hottest weeks of summer are to be avoided by most people.

Baden-Baden (Grand Duchy of Baden), the Nieder-Baden referred to by Paracelsus, so called to distinguish it from Baden in Switzerland (formerly styled Ober-Baden) and Baden near Vienna, was already known to the Romans as 'Colonia Aurelia Aquensis' or 'Aquæ Aureliæ.' It lies at an altitude of about 650 feet, in a situation almost unrivalled for natural beauty, in the Oos Valley, close to the fertile plain of the Rhine. Though not completely sheltered from the north, its climate is mild, with early spring and late summer.

There are over twenty different thermal springs; their waters closely resemble each other in mineral constituents, and their temperatures vary from 124° to 150° F.² The Hauptstollenquelle

¹ F. Henrich, 'Ueber die Radioaktivität der Wiesbadener Thermalquellen,' *Jahrbücher des Nassauischen Vereins für Naturkunde*, 1905, Jahrgang 58; quoted by P. Bergell and A. Bickel, 'Experimentelle Untersuchungen über die physiologische Bedeutung der Radioaktivität der Mineralwässer,' *Zeitschrift für klinische Medizin*, Berlin, 1906, vol. lviii. p. 235. The deposit doubtless contains radium.

² Radio-activity has been detected by Himstedt (*Physikalische Zeitschr.* 1904, p. 210) and others in the Baden-Baden springs and the sediments from the springs (see Chapter XIII). H. Sieveking (*Berliner klinische Wochenschrift*, 1906, Nos. 23 and 24) by his special apparatus finds that the radio-activity of the Büttquelle (not at

is the one most used for drinking, and contains 2 per mille common salt, 0·05 per mille chloride of lithium, and a trace of arsenic (0·0007 per mille arseniate of calcium). The lithium has been said to exercise a special therapeutic action in gout, and the arsenic in skin affections; but it is probably more rational to regard the waters of Baden as simple muriated thermal waters, which, owing to their weak mineralisation, approach the indifferent thermal group of waters. If a laxative action be desired, Karlsbad, Marienbad, or Kissingen salts may be added to the Baden water.

The waters are much used for drinking, but still more for bathing. The Friedrichs-Bad and the Kaiserin-Augusta-Bad (the latter for ladies only) are amongst the finest, if not the finest, bath-houses in Europe. Here various kinds of baths may be had: ordinary thermal baths, strengthened by the addition of salt if necessary; the so-called 'Wild-Bäder,' i.e. baths with a sandy floor, as at Wildbad, in which the thermal water is kept continually running to imitate bathing at a natural thermal fountain; local and general hot air and vapour baths (for the vapour baths the natural thermal water is used); all kinds of douches and electric baths. In the Friedrichsbad is a very complete set of Zander's medico-mechanical appliances. There is an institution containing chambers for compressed air. Local baths of mud ('fango') can be employed as at Battaglia.

The indications for Baden-Baden are: rheumatoid arthritis and chronic gouty affections in delicate subjects; the results of injuries to bones and joints, chronic skin affections, &c., in which ordinary thermal baths are useful; catarrhal and nervous affections of the digestive organs in delicate people, in whom the more active waters of Karlsbad &c. are contra-indicated. For convalescents, cachectic conditions from malaria, emphysema, and chronic catarrh of the respiratory organs, the climate is often likely to prove favourable. For emphysema and chronic bronchitis the use of the compressed-air chambers is said to be useful.

The neighbouring walks are suitable for a 'Terrain-Cur' in persons with weakly acting hearts from obesity, &c. On the present in use) of Baden-Baden approaches that of the most radio-active Gastein springs. According to the table given by him the radio-activity of different springs may be compared as follows: the Friedrichsquellen of Baden-Baden 6·9, the Murquelle of Baden-Baden 27·3, the Büttquelle of Baden-Baden 108·8, the Sprudel of Karlsbad 0·2, the Schlossbrunnen of Karlsbad 8·9, the Felsenquelle of Karlsbad 5·4, the Kaiserbrunnen of Karlsbad 5·1, the Eisenquelle of Karlsbad 54·5, the Grabenbäckerquelle (the most radio-active spring) of Gastein 149·0, the Karlsquelle of Griesbach 23·8, the Sophienquelle of Petersthal 4·0, the Antoniusquelle of Antogast 15·1, the Stahlquelle of Freyersbach 7·3. See also R. Stegmann and G. Just, 'Die Wirkungen der Baden-Badener Thermen vom Standpunkte ihrer Radioaktivität,' *Wiener klin. Wochenschrift*, 1906, No. 25, p. 761.

hottest days cool walks in the dense pine forests can always be selected, and for those patients who are able to make excursions of some hours' duration, the ruins of the old Castle of Baden, the porphyry cliffs close by, the ruins of Ebersteinburg,¹ Schloss Eberstein, and Yburg are amongst the points on the neighbouring heights which may be visited.

Owing, however, to the beauty of the town itself, its handsome villas and hotels, the magnificent scenery around it, the numberless excursions which can be made, and the amusements it offers to the fashionable world, Baden must necessarily attract more ordinary visitors than patients. The chief season is from May 1 to the end of October, but there is also a winter season. Those invalids who do not bear heat ought to avoid Baden between the beginning of July and the middle of August. Baden is often used as an intermediate station for those about to spend the winter in the South of Europe, and those returning from warmer regions to their colder homes. The accommodation is good. Besides hotels and 'pensions,' there are two or three private sanatoria, where patients can be under the direct supervision of the physician.

Woodhall Spa (England, Lincolnshire).—Woodhall Spa (altitude 37 feet above sea-level), noted for its cold muriated waters containing minute quantities of bromides and iodides, lies amidst a nearly level kind of moorland bordering on the fens. Owing to the flatness of the country, sea breezes reach it, though the spa lies actually about 23 miles due west of the coast, i.e. of the little seaside health resort of Skegness. The climate, like that of the east coast, is bracing, and the rainfall is moderate for England. The Scotch firs and woodland in the neighbourhood contribute to the healthiness of the situation. According to Professor Frankland's analysis of 1891, it appears that the Woodhall waters contain 19·5 per mille common salt, 1·27 per mille chloride of calcium, 1·14 per mille chloride of magnesium, 0·4 per mille bromide of sodium, 0·02 per mille bromide of potassium, and only 0·0075 per mille of iodide of potassium (no free iodine).

Amongst diseases in which benefit has been obtained by the use of this spa are rheumatoid arthritis, muscular rheumatism, gouty affections, and catarrh of the respiratory and alimentary tracts; also scrofula and rickets, cases of leucorrhœa in women, and some skin affections. Dr. Williams found the water useful in fibroid tumours of the uterus, which is in accordance with results which have been claimed for the somewhat similar waters

¹ At Ebersteinburg is a private sanatorium (1,380 feet) for ladies with slight pulmonary tuberculosis.

of Kreuznach, in Germany (q.v.). A 'Mutterlauge,' made from the Woodhall water, can be used like that of Kreuznach for local compresses or for strengthening the baths. The waters are likewise used for inhalation purposes in chronic pharyngeal and laryngeal catarrh, and for nasal douches.

The bath establishment contains arrangements for baths, douches, and the Aix douche-massage; crippled invalids can be lowered into their baths on a 'crane-couch.' The accommodation is good, and for those who are fit there are excellent facilities for golf, cycling, lawn tennis, &c.

Ashby-de-la-Zouch (England, Leicestershire).—The mineral waters of this spa (altitude about 400 feet) were discovered in 1805, during the working of the Moira coalfields in the neighbourhood. Their natural temperature is 62° F., and, according to Dr. B. H. Paul's analysis, they contain 18·7 per mille common salt, 2·2 per mille chloride of calcium, 1·6 per mille chloride of magnesium, 2·5 per mille sulphate of calcium, and 0·08 per mille carbonate of iron. They are used for giving brine baths (much weaker than those of Droitwich and Nantwich) at various temperatures.

The baths are employed in muscular rheumatism, in chronic rheumatic, gouty, and also scrofulous affections. Owing to the carbonate of iron in the waters, their internal employment when somewhat diluted might be useful in various conditions of debility. The bathing establishment is small, but there is comfortable hotel accommodation, and pleasant excursions can be made in the neighbouring country.

Malvern (England, Worcestershire) is supplied with brine from Droitwich. The Malvern Wells (St. Anne's Well, Holy Well) were formerly famed for their supposed special effects, which were doubtless due in part to the drinking of a nearly pure water in excellent air, and in part possibly to faith. Great Malvern lies on the eastern slopes of the Malvern Hills, and the houses are scattered about at different levels—average about 520 feet. Malvern Wells and Little Malvern lie respectively two and three miles to the south of Great Malvern; North Malvern lies on the northern slope; West Malvern is built on the western side of the range, at a somewhat higher level than Great Malvern. The Malvern neighbourhood is much visited by convalescents and invalids for whom a tonic inland climate is suitable. The situation is beautiful, the accommodation comfortable, and there are plenty of excursions to be made in the neighbourhood.

Nantwich (England, Cheshire).—Nantwich (altitude about 120 feet) is situated in a pleasant well-wooded country. According to Frankland's analysis, the waters contain about 21 per cent.

common salt, 2·2 per mille chloride of magnesium, 1·9 per mille chloride of potassium, 6·5 per mille sulphate of calcium, and 5·0 per mille sulphate of sodium.

The brine baths were opened in 1883, and resemble those of Droitwich, but the baths are heated with steam instead of hot water, and therefore can be given less diluted than at Droitwich. Cases of lumbago and muscular rheumatism often receive benefit from the treatment. The summer months are to be preferred.

The brine baths of STAFFORD (altitude about 240 feet) are similar to those of Droitwich. At SALTBURN-BY-THE-SEA, in Yorkshire, baths are employed of brine conveyed from the brine wells (25 per cent. of common salt) at MIDDLESBOROUGH. At MIDDLEWICH, in Cheshire,¹ there are brine baths.

Other muriated waters in England are those of Filey and Thorp Arch (or Boston Spa), in Yorkshire, and Admaston, under the Wrekin, in Shropshire.

Harrogate (England).—Some of the Harrogate waters might be mentioned in the muriated as well as the sulphurous group. (See Chapter XXV.)

Llandrindod Wells and Builth Wells (Wales, Radnorshire).—These spas are described amongst the sulphur springs. (See Chapter XXV.)

Llangammarch Wells (Wales, Brecknockshire).—This spa (altitude about 600 feet) possesses a muriated water, the so-called ‘barium water,’ containing chlorides of calcium, magnesium, and barium. Dr. Dupré’s analysis shows it to contain about 2·6 per mille common salt, 1·2 per mille chloride of calcium, 0·3 per mille chloride of magnesium, and 0·096 per mille chloride of barium (total solids, 4·3 per mille).

Llangammarch is situated at the southern foot of a range of hills, in a wide valley, fairly sheltered to the north and east. The air is fresh, and invigorating to those suffering from mental overwork. The water is used externally and internally, and might be useful in some cases of dyspepsia, and in chronic gout and rheumatism, especially where any emaciation is to be avoided.

Chloride of calcium has some reputation in chronic glandular affections, &c., whilst chloride of barium (compare Chapter XIV), the speciality of the waters, is said to raise the blood pressure and produce diuresis by a tonic action on the muscular coats of the arteries. Artificial Nauheim gaseous baths are made use of in suitable cardiac cases.

¹ There is a very rich salt district in Cheshire. Northwich, with its salt mines and brines, is the principal town of this district from the commercial point of view. Here the pumping out of enormous quantities of brine has led to subsidence of the ground, houses and all, in different parts of the town.

The Llangammarch waters are exported, both plain and after being artificially aerated. In the latter form they are a pleasant drink at meals. Although Llangammarch Wells water is, chemically speaking, a worse solvent of uric acid than ordinary tap water, yet according to an investigation carried out by Black Jones and E. Russell ('Lancet,' 1899, vol. i. p. 830), when substituted dietetically for ordinary water, it led to increase in the excretion of uric acid and in the quantity of urine.

Bridge-of-Allan, Airthrey (Scotland, Stirlingshire) (altitude 40 to 200 feet), lies on the Allan at the south-western foot of the Ochil Hills, 3 miles to the north of Stirling, with which it is connected by railway and tram. It stands in a picturesque sheltered position, partly on the hillside and below thickly wooded slopes, on which pleasant walks may be taken. The place has a reputation for a rather mild equable climate, like Cheltenham in England.

The Airthrey mineral water is said to contain about 6·3 per mille common salt, 4·4 calcium chloride, 0·1 magnesium chloride, and 0·4 sulphate of calcium.¹ Its taste is naturally somewhat different from that of ordinary common salt waters. One to three tumblers before breakfast is the usual dose. It is often heated artificially before being drunk, and in some cases exerts a slight aperient action. The water has a reputation for dyspeptic troubles. There are facilities for hydrotherapy at Bridge-of-Allan and at DUNBLANE (3 miles distant).

INNERLEITHEN (Scotland, Peebles), on the River Tweed, about 6 miles below Peebles, has weak muriated waters, bottles of which can be obtained in London under the name, 'St. Ronan's table water.' According to Stevenson Macadam the so-called sulphur spring contains a little sulphuretted hydrogen in addition to the chlorides (2·6 per mille sodium chloride and 1·7 calcium chloride), whilst the other spring is not sulphurous, but contains rather more chlorides (3·5 sodium chloride and 2·1 calcium chloride). The muriated waters of **BRIDGE-OF-EARN (PITKEATHLY)**, situated on the Earn (altitude about 30 feet), in a broad valley 4 miles from Perth, are said to contain free carbonic acid gas. 'Pitkeathly water' and 'Pitkeathly cum lithiâ' are waters prepared by the lessees of the Wells, and sold in bottles.

Mondorf, in the Grand Duchy of Luxemburg (altitude 650 feet), possesses a muriated water (temperature 77°) which, in addition to 8·7 per mille common salt, contains 3·1 per mille bromide of magnesium. The waters are used for drinking, bathing, and inhalation.

¹ Cf. Dr. W. Haldane, 'Bridge of Allan as a Health Resort,' in the *Scottish Medical and Surgical Journal*, August 1898.

Oeynhausen, or Rehme-Oeynhausen (Germany, Westphalia). The town lies in a shallow fertile valley (altitude 230 feet) on the Werre, not far from the junction of the Werre with the Weser, and 6 miles from the picturesque 'Porta Westphalica,' where the Weser leaves the Westphalian Hills. Oeynhausen, the newer portion of the town, is the name by which the spa is now best known. The climate is fresh and mild, and there is a beautiful Kur-Park with plenty of shady walks.

The chief remedial agents are four muriated wells, termed Bohrloch I., Bohrloch II., Bohrloch III., and Bohrloch IV. (the latter discovered in 1898), very rich in carbonic acid gas, with temperatures of 77° to 91.5° F., containing about 31 to 34 per mille common salt. Bohrloch No. I. (temperature 80.6° F.) contains about 32 per mille common salt, and 3 per mille each of the sulphates of sodium and calcium, and something like 1,000 volumes per mille of carbonic acid gas. The Bülow-brunnen are two cold muriated springs containing 34 to 80 per mille common salt. The waters of Oeynhausen are almost solely employed for external treatment. The bathing arrangements are very good, and by the mixing of the different waters together and heating them, if necessary, baths can be given at different temperatures and of various strengths in salt and gas. There are likewise 'Gradirhäuser' for inhalation purposes.

So much do the remedial agents of Oeynhausen resemble those of Nauheim that it will not be necessary to repeat here what has been already said, when speaking of the latter spa, concerning indications for treatment. Owing to special treatment of heart affections, Nauheim has become much better known in England than Oeynhausen. The latter spa has, however, owing to the special attention paid to the subject by its medical men (J. Braun, L. Lehmann, &c.), and their writings¹ on the subject, acquired a considerable reputation in those cases of nervous affection which are suitable for spa-treatment. Many of the patients who come for treatment are sufferers from tabes dorsalis or other organic affections of the nervous system. There is an institution fitted up with Zander's medico-mechanical appliances for active and passive exercises, and there are also facilities for the treatment of the ataxy of tabes dorsalis by methodical movements, as recommended by Frenkel of Heiden and others. The chief season is from May 15 to the end of September; but there is likewise a winter season.

Soden in the Taunus (Germany, Prussian Province of Hesse-Nassau) lies at an altitude of about 450 feet, 7 miles to the

¹ Vide L. Lehmann, *Die chronischen Neurosen als klinische Objekte in Oeynhausen*, Bonn, 1880.

west of Frankfurt-am-Main, just at the foot of the Taunus Mountains, which shelter it on the north. The climate is relatively mild and equable for that part of Europe. There are 24 different muriated springs, designated by numbers like those of Nauheim; they vary in amount of common salt (2·4 to 15·0 per mille), and in temperature (52° to 86° F.); some of them, as the 'Champagner-Brunnen' (6·5 per mille common salt), are very rich in carbonic acid gas; the 'Sool-Brunnen' contains 14·2 per mille common salt and comparatively little carbonic acid. These and the 'Warm-Brunnen' and 'Milch-Brunnen' (3 and 2 per mille common salt) are much used for drinking. Some of the springs contain an appreciable amount of iron; the 'Soolensprudel' (temperature 86° F.), used for 'Thermal-Soolbäder,' like those at Nauheim, is specially rich in carbonic acid gas (1,525 per mille volumes), and smells slightly of sulphuretted hydrogen. The bath-house is well fitted up for the ordinary and gaseous baths. There are special rooms for gargling, inhalation chambers on the Schnitzler, Wassmuth or other systems, and apparatus for respiration with alternately diminished and increased atmospheric pressure. There are likewise arrangements for hydrotherapy, electrotherapy and massage. Good milk from cows and goats can be obtained. Twenty minutes distant from Soden is the gaseous chalybeate spring of NEUENHAIN (0·04 per mille bicarbonate of iron).

Soden is chiefly resorted to by Germans with chronic catarrhal affections of the respiratory organs and emphysema. Other patients are scrofulous and weakly children and convalescents from acute diseases. Heart affections can be treated at Soden as at Nauheim, and disorders of digestion and metabolism as at Homburg and Kissingen. The chief season is from May to the end of September.

As somewhat similar to the gaseous thermal muriated waters of Nauheim, Oeynhausen, and Soden, may be mentioned the waters of HAMM, KOENIGSBORN, and WERNE, in Westphalia.

Salzschlirf (Prussian Province of Hesse-Nassau), a station on the railway between Fulda and Giessen, is situated at an altitude of 820 feet in a pleasant valley to the north-east of the Vogelsberg. The muriated spring, 'Bonifacius-Brunnen,' used for drinking and bathing, according to Fresenius and Will, contains (total solids, 14 per mille) 10 per mille common salt, 1·5 per mille sulphate of calcium, about 1 per mille chloride of magnesium, 0·21 per mille chloride of lithium, and about 0·005 per mille each of iodide and bromide of magnesium, with a fair amount of carbonic acid gas. Some importance has been attached to the lithium and iodine of this water in the treatment of chronic gout, rheumatism,

and the 'uric acid diathesis.' The 'Tempel-Brunnen' (total solids, 16 per mille) is rather more highly mineralised, and contains 0.05 per mille bicarbonate of iron, but has less lithium than the Bonifacius-Brunnen. The Kinder-Brunnen and the Schwefel-Brunnen contain much less solids; the former, when artificially aerated, is used as a table-water; the latter contains about 6 per mille volumes of sulphuretted hydrogen. The springs are all cold. Thermal gaseous muriated baths and 'Moorbäder' are made use of. The season is from the middle of May to the end of September.

The gaseous muriated sulphated water, termed 'Hessisches Bitterwasser,' from the neighbouring village of GROSSENLUEDER (containing, according to Reichardt, 15.4 per mille common salt, 1.3 per mille sulphate of magnesium, 1.6 per mille each of the sulphate and carbonate of calcium, and 0.04 per mille carbonate of iron), is employed for its laxative action.

Kiedrich (Prussian Province of Hesse-Nassau), near Eltville, on the Rhine, at the foot of the Taunus Mountains, has a sanatorium, and the 'Kiedricher Sprudel'—a muriated spring—which, with 6.8 per mille common salt, according to the analysis of H. Fresenius in 1900, contains 0.4 of potassium chloride, 1.0 of calcium chloride, and 0.055 of lithium chloride. Some importance has been claimed for the lithium chloride in this water.

Schmalkalden (Prussian Province of Hesse-Nassau) lies at an altitude of 970 feet, on the south-western declivity of the Thuringian Forest, and is the terminus of a branch of the 'Werra' railway from Wernshausen. The earthy muriated water (temperature 63° F.) contains, according to Koebrich, 9.4 per mille common salt and 2.5 per mille sulphate of calcium. The walks in the neighbouring woods might be used for a 'Terrain-Cur.'

Aachen, or Aix-la-Chapelle, in Rhenish Prussia.—This spa has for convenience been described under 'Sulphurous Waters' (Chapter XXV), but might equally well have been classified as having thermal muriated waters.

Münster-am-Stein (Rhenish Prussia) is situated at an altitude of 380 feet, about $1\frac{1}{2}$ miles further up the Nahe Valley than Kreuznach. The waters are similar but warmer (temperature of the Haupt-Brunnen, 87.8° F.), and it will be unnecessary to add anything to what has been already said under 'Kreuznach' (*q.v.*). Accommodation is good, though arrangements are somewhat simpler than at Kreuznach.

Pyrmont (Germany, Principality of Waldeck-Pyrmont) in addition to its chalybeate springs possesses muriated waters with 7 to 32 per mille common salt. (See under the Chalybeate Waters, Chapter XXIII.)

Arnstadt (Thuringia, Principality of Schwarzburg-Sondershausen) is a summer resort in a sheltered locality at the northern border of the Thuringian Forest (altitude 920 feet). It possesses strong muriated ($26\frac{1}{2}$ per cent.) waters, used for brine baths.

Frankenhausen (Thuringia, Principality of Schwarzburg-Rudolstadt) lies at an altitude of 370 feet in a sheltered valley on the southern declivity of the Kyffhäuser. It possesses muriated waters (2 to 25 per cent.). The station is on a branch line of the railway between Sangerhausen and Erfurt. Interesting excursions can be made on the Kyffhäuser to the 'Barbarossa Cavern,' &c. There is an establishment for the treatment of scrofulous children.

Koestritz, in the Principality of Reuss (altitude about 550 feet), is pleasantly situated in the Elsterthal, and has a station on the railway between Zeitz and Gera. The brine used for its 'Soolbäder' is obtained from the neighbouring Heinrichshall salt-works, and contains 22 per cent. common salt.

The special feature, however, of Bad Koestritz is the employment of hot sand baths, which were introduced there in 1865. A rather coarse sand from the bed of the Elster is used for the baths, and when properly embedded in the sand the patient is wheeled out into the open air. An ordinary bath lasts about an hour; the sand is then washed off the body with warm water, and the sweating process is maintained for some time longer, whilst the patient rests wrapped up in blankets. Every third day or so, according to special indications, the sand bath is omitted, but the patient often has a brine or other bath instead. Massage can likewise be employed when advisable, and sometimes local sand baths are given, or the sand applied to the affected part is heated to a higher temperature than that applied to the rest of the body. Besides chronic rheumatic and gouty affections and 'neuralgias' (doubtless including sciatic neuritis &c.), Dr. Sturm¹ mentions certain cases of chronic albuminuria as having been improved by the treatment.

Salzhausen (Grand Duchy of Hesse) is situated at an altitude of 470 feet, at the southern foot of the Vogelsberg, $1\frac{1}{4}$ miles from the railway station of Nidda. Of its weak muriated waters the strongest has about 1 per cent. of common salt, 1 per mille chloride of magnesium, and a moderate amount of free carbonic acid gas. The water is used for drinking; for bathing a concentrated water is used, if necessary, strengthened by 'Mutterlauge' from Kreuznach or Nauheim. There are likewise a sulphur spring and a chalybeate one.

¹ Vide Ad. Sturm, *Nachrichten über Bad Koestritz und seine Kurmittel, besonders seine warmen Sandbädern.*

Salzufen, or **Salzuffen** (320 feet), in the Principality of Lippe-Detmold, a station on the railway between Herford and Detmold, possesses a muriated water containing 4 to 9 per cent. common salt. There are 'Gradirhäuser' in the neighbourhood.

Salzungen (Germany, Duchy of Saxe-Meiningen) lies in the broad Werrathal, at the south-western declivity of the Thuringian Forest, about 780 feet above the sea-level. A small lake with shady banks forms a pleasant feature of the spa. The muriated waters vary in strength from 5 to $25\frac{1}{2}$ per cent. The baths are ordinarily made with a 5 to 6 per cent. muriated water, but a stronger brine or Mutterlauge can be added. The Salzungen Mutterlauge contains out of a total of about 55 per cent. solids about 47 per cent. chloride of magnesium, 2·5 per mille bromide of magnesium, and 1·3 per mille iodide of magnesium. Inhalation treatment is much employed at Salzungen. The Gradirhaus (partially covered in) is maintained merely on account of its medical utility. Pulverisation is likewise carried out by ordinary modern methods in chambers adjacent to the Gradirhaus. For the inhalation treatment Salzungen is visited by sufferers from chronic affections of the bronchi and respiratory organs, including some cases of pulmonary tuberculosis. There is an excellent sanatorium at this spa for the charitable treatment of scrofulous and weakly children. The railway station is on the line between Eisenach and Meiningen. (Season, May 15 to end of September.)

Sulza (Thuringia, Grand Duchy of Saxe-Weimar) possesses brines of strengths varying from 5·1 to 14·5 per cent., containing small quantities of iodine, bromine, and iron. The place, consisting of town, village, and salt works, lies between Weimar and Naumburg, on the Ilm, at an elevation of 480 feet.

Eisenach (Grand Duchy of Saxe-Weimar), the beautiful Thuringian town at the foot of the Wartburg (see also Part I, Chapter IX), possesses the muriated Karolinenquelle (9·7 per mille common salt and 3 per mille calcium sulphate) conducted from Wilhelmsglücksbrunn (Creuzburg an der Wartburg). At the Sophienbad in Eisenach there are facilities for salt baths (Karolinenquelle), hot air baths (including electric light baths), vapour baths, massage, &c. There are likewise other establishments for hydrotherapy &c. at or near Eisenach.

Niederbronn (Germany, Alsace), the chief Alsatian spa (altitude 620 feet), is situated at the eastern declivity of the Vosges Mountains, on the railway from Hagenau to Saargemünd. Its principal muriated spring contains about 3 per mille common salt, 0·6 per mille chloride of calcium, and 0·01 per mille bicarbonate of iron (temperature 64° F.). The waters are chiefly used for

drinking in cases of dyspepsia and catarrh of the bowels. In former centuries they were used for prolonged baths.

Rothenfelde is a 'Soolbad' in Hanover, situated at an elevation of 360 feet at the southern foot of the Teutoberger Wald. The muriated water contains a total of 67 per mille solids, 56 per mille being common salt, the rest consisting of chloride of magnesium, bicarbonate of calcium, &c. A concentrated brine, a 'Mutterlauge,' and a dried 'Mutterlauge,' and a weaker muriated water for drinking (14.5 per mille common salt) are likewise made use of. The 'Mutterlauge' contains 12.6 per mille bromide of magnesium. The railway station is on the line between Brackwede and Osnabrück.

Harzburg with its establishment of JULIUSHALL (Duchy of Brunswick, altitude 850 feet) lies close under the Burgberg at the northern declivity of the Harz Mountains. There are two cold muriated springs, viz. (1) the Krodoquelle (14.9 per mille common salt, poor in carbonic acid gas), much used for courses of internal treatment, taken cold or warmed according to circumstances; (2) a stronger muriated water (between 6 and 7 per cent. common salt) used for ordinary brine baths. The bathing arrangements are new. A simple gaseous water of Juliushall is to be had in bottles.

Harzburg is much visited by the inhabitants of Northern Germany as a summer health resort, on account of its beautiful situation, its shady walks, and the numerous excursions to be made in the Harz Mountains. The railway station of Harzburg is about $\frac{3}{4}$ mile away from the higher portion of the health resort. A limited amount of accommodation is to be had at the top of the Burgberg, 1,555 feet above sea-level.

Segeberg, in the Province of Schleswig-Holstein. The Kurhaus is pleasantly situated in a park, close to the town, on slightly elevated ground overlooking the little Lake of Segeberg. The brine (Soole) of Segeberg, according to Skälweit's analysis, contains 26.4 per cent. common salt and 1 per cent. magnesium sulphate. In addition to the brine baths, which can be given of various strengths, there are arrangements for mud baths, sand baths, pine baths, &c., and likewise for bathing in the lake. The isolated hill, called the 'Kalkberg,' not far from the establishment, affords a panoramic view of the whole surrounding plain. The railway station of Segeberg is about 1 hour distant from Lübeck, and $1\frac{1}{2}$ hours from Hamburg and Kiel.

Oedesloe (Schleswig-Holstein) possesses a cold brine, the Kaiserquelle (22.9 per mille common salt according to Sonder's analysis), and a muriated sulphur spring, the Schwefelquelle (12 per mille common salt), as well as excellent arrangements for

sulphurous moor baths. The thermal establishment, which has been enlarged and modernised, adjoins a wood with numerous shady paths. The railway station of Oedesloe is an important junction on the line between Hamburg and Lübeck.

Kolberg, or **Colberg** (Pomerania), on the Baltic Sea, has, besides its sea baths, muriated waters containing 2.1 to 5.1 per cent. common salt, 0.6 to 1.8 per mille chloride of magnesium, and 1.5 to 4.4 per mille chloride of calcium. There are sanatoria for the treatment of scrofulous children, &c.

Inowrazlaw (Prussia, Province of Posen) is a railway station at 1 hour's distance from Bromberg. According to an analysis of 1875 its 'Bassinsoole' contains 30.6 per cent. common salt, and may therefore be compared in concentration to the brines of Droitwich and Rheinfelden.

Elmen, or **Alten-Salza**, in the Prussian Province of Saxony (altitude 150 feet), is situated near Gross-Salza, on the railway, 40 minutes distant from Magdeburg. It is one of the oldest brine baths in Germany, and possesses, amongst other springs, the 'Victoria-Quelle' (26 per mille common salt), used for drinking, and a spring used for bathing, containing about 5 per cent. common salt and 0.6 per mille bromide of magnesium.

Koesen (Prussian Province of Saxony), a 'Soolbad' pleasantly situated on the Saale, at an altitude of 370 feet, near Naumburg, possesses a 5 per cent. brine (temperature 65.5° F.), and a sanatorium for scrofulous children from Berlin.

Wittekind (Prussian Province of Saxony, altitude 200 feet) is an establishment close to the ruined castle of Giebichenstein, near the University city of Halle-on-the-Saale. It possesses a muriated water (3½ per cent.), which may be strengthened with 'Mutterlauge,' or bath salt, for bathing. The water is artificially charged with CO₂, when gaseous salt baths are required. Moor baths are likewise to be had, made with ferruginous peat from Schmiedeberg. The establishment is 20 minutes by electric tramcar from the railway station of Halle. The salt springs (~~Halloren~~) of **Halle** helped to give the city importance at a very early period.

Neu-Ragoczi, or **Bad-Ragoczi** (Prussian Province of Saxony), named after the famous (Rakoczy) spring in Kissingen, is an establishment on the River Saale, 1 hour distant from Halle. It possesses muriated springs (up to 1 per cent. of common salt).

Thale (altitude 630 feet), in the Prussian Province of Saxony, is a summer resort on the northern border of the Unter-Harz, at the entrance to the Bodethal, one of the most beautiful districts of the whole Harz Mountains. The **HUBERTUSBAD**, on an island in the Bode, just below the Rosstrappe, is supplied by the

'Hubertusbrunnen,' a muriated water containing 14·3 per mille common salt and 10·7 per mille chloride of calcium. The railway station of Thale is the terminus of a line from Quedlinburg and Halberstadt.

Dürrheim (Grand Duchy of Baden), in the Black Forest, at an altitude of 2,300 feet, 3 miles to the east of the railway station of Marbach, possesses a very strong brine (total solids, 26·2 per cent., according to Bunsen), used for bathing, and satisfactory hotel accommodation. Dürrheim claims to have the most elevated position of all 'Soolbäder' in Europe. Certainly its altitude must give it an advantage in many cases over places possessing equally or still more concentrated brines, such as Rheinfelden (*q.v.*), in Switzerland, and Droitwich (*q.v.*), in England.

Canstatt (Cannstatt) and **Berg**, near Stuttgart, Württemberg. These places adjoin each other, and are connected by a tramway with Stuttgart, of which town they practically form the north-eastern suburb. There are several springs, the most used of which are the Wilhelmsbrunnen at the 'Kursaal,' and the Sprudel and Inselquelle, situated between Berg and Canstatt on a small island of the Neckar. The springs yield tepid earthy muriated waters (about 2 per mille common salt and 1 per mille carbonate of calcium), fairly rich in carbonic acid gas, which can be used for drinking and bathing in catarrhal affections of the digestive and respiratory organs.

The mild sheltered climate is of great assistance in some cases, but, unfortunately for its usefulness as a spa, Canstatt is more and more assuming the character of the manufacturing suburb of an important town.

For drinking purposes the laxative action of the waters may be increased, if desirable, by the addition of Karlsbad salt, &c., and for bathing purposes the waters may be heated to a suitable temperature. The season lasts from the beginning of May to the middle of October.

Hall in Württemberg (Schwäbisch Hall) is a picturesque old place, situated at an altitude of about 980 feet. It possesses a muriated water (23 per mille common salt) which by the addition of a more concentrated brine, or of 'Mutterlange,' may be used for 'Soolbäder' of different strengths. There is also a weak sulphur spring. The season lasts from May 1 to October 1.

Jaxtfeld, or **Jagstfeld**, in Württemberg (altitude 450 feet), lies at the junction of the Jagst with the Neckar, 6 miles from the railway station of Heilbronn. It possesses a 26 per cent. brine used for bathing, and an establishment (Bethesda) for weakly children.

Dürkheim (altitude 380 feet), in Rhenish Bavaria, lies amidst vineyards at the eastern foot of the Hardt Mountains, at the entrance of the Isenachthal. Its muriated waters, which are mainly used for bathing, contain $\frac{3}{4}$ to 2 per cent. of common salt, and have the historical interest that in them the rarer metals, cæsium and rubidium, were first discovered, though, of course, only in traces.

The Gradirwerk, connected with the salt works, is used for inhalation purposes, and is similar to those at Reichenhall, Kissingen, &c. There are beautiful shady walks on the neighbouring wooded slopes, and interesting excursions can be made to the so-called Haidenmauer, the romantic ruins of Limburg and Hartenburg, &c. Dürkheim, like some neighbouring places in the Hardt Mountains (Neustadt, Edenkoben, Gleisweiler, and Annweiler) may be used for a grape-cure in the autumn. Flies and gnats are sometimes rather troublesome, and in summer the heat may be oppressive.

Sodenthal (Northern Bavaria) is situated in a pleasant valley of the Spessart, about $1\frac{1}{2}$ hours distant from Aschaffenburg, at an elevation of 470 feet above sea-level. It is sheltered by neighbouring heights from cold north and east winds. The air is pure and free from dust; and the beech and pine forest surrounding the place helps to render its climate moderately moist and equable. The No. 1 spring yields cold muriated waters containing 13·8 per mille common salt, 6·9 per mille calcium chloride, together with small quantities of magnesium iodide, magnesium bromide, lithium chloride, and calcium sulphide. There is an establishment for hydrotherapeutic treatment. The season lasts from the beginning of May to the end of October.

Berchtesgaden, in Upper Bavaria, near the Austrian border, is a summer health resort, in a sheltered position on the southern slope of the Untersberg, having an altitude of about 1,890 feet, and possessing a $26\frac{1}{2}$ per cent. brine. The surplus of the Berchtesgaden brine is conducted by pipes to Reichenhall, which in its turn supplies Rosenheim and Traunstein with a mixture of its own and Berchtesgaden brines.

Both the climate and brine baths of Berchtesgaden can be of service in the treatment of rachitic and scrofulous conditions. Owing chiefly to its position, the place is used in the treatment of chronic affections of the respiratory organs, or for a rest after a course of waters at Karlsbad, Marienbad, &c. Berchtesgaden is very beautiful, and the pleasant and popular excursions in the neighbourhood (the Königssee, the salt mines, &c.) bring it a number of ordinary holiday guests and tourists, as well as patients requiring its climate or baths. It is too much shut in by

mountains to be called bracing. The season is from the middle of May to the middle of October. Berchtesgaden is one hour distant by the local railway from Reichenhall. There is likewise direct communication with Salzburg, partly by omnibus, partly by a local steam-tram line.

Reichenhall, in the Bavarian Alps, close to the Austrian frontier, is situated in the fairly broad valley of the Saalach at an elevation of 1,570 feet above the sea. On the east, south, and west the valley is shut in by mountains; towards the north-east, in the direction of Freilassing, it is open. The winds from the north and north-east are, however, of infrequent occurrence. The mean summer temperature is about 62·8° F. The surrounding country is beautiful, and the climate may be called fairly bracing.

Of the numerous salt springs at Reichenhall the Edelquelle (about 22 per cent. of common salt) and the Karl-Theodorquelle are the most important; their waters are mixed together for baths, which may be strengthened by the addition of Reichenhall 'Mutterlauge,' rich in chloride of magnesium. For internal use the water is diluted. At the 'Trinkhalle' excellent goat's whey and the best known waters of other spas can be obtained in the morning. A laxative 'bitter water' has, moreover, been artificially prepared from the 'Mutterlauge.' For inhalation purposes there are the 'Gradirwerke' (in the Kurgarten), with the spray from a neighbouring brine fountain, and inhalation rooms where the finely pulverised water may be inhaled. There are chambers for compressed air baths employed in emphysematous and chronic bronchitic conditions. There are also excellent arrangements for artificial gaseous baths in imitation of the natural baths of chalybeate spas and the Thermal-Soolbäder of Nauheim.

Chronic catarrhal conditions of the respiratory organs are amongst the cases most frequently treated at Reichenhall. Various conditions of general debility are likewise suited. Walks have been arranged and carefully mapped out for a 'Terrain-Cur' after Oertel's views in fatty infiltration of the heart, &c. The season lasts from the middle of May to the end of September. Reichenhall is connected by a branch-line with Freilassing, a station on the railway between Munich and Salzburg.

Besides its own brines Reichenhall receives the surplus of the Berchtesgaden brine, and a mixture of these brines is conducted by pipes to Rosenheim and Traunstein.

Rosenheim (altitude 1,640 feet), in Upper Bavaria, is situated on the plain to the north of the Bavarian Mountains, at the junction of the Mangfall with the Inn. It has brine baths, supplied with a 24 per cent. brine from Reichenhall (i.e. a mixture

of the Reichenhall and Berchtesgaden brines). There is also a weak chalybeate spring. Rosenheim is a railway junction on the line between Munich and Salzburg.

Aibling (altitude 1,575 feet) is a pleasant place in Upper Bavaria, with a railway station 6 miles to the west of Rosenheim, which supplies the brine for its baths. The moor baths, for which Aibling is chiefly known, are made up with brine and 'Mutterlauge,' and are employed for the results of old pelvic inflammation, old articular troubles, scrofulous affections, &c. There are likewise two weak chalybeate springs.

Traunstein (Upper Bavaria), altitude 1,960 feet, pleasantly situated on the slopes above the Traun, is a station on the railway between Munich and Salzburg. It has brine baths supplied with brine from Reichenhall (a mixture of the Reichenhall and Berchtesgaden brines). There are pleasant shady walks in the neighbourhood.

Kreuth (Bavaria) possesses brine baths supplied from a distance; but it is doubtless the climate, due to its position in the Bavarian Mountains 2,700 feet above the sea, which gives the place its chief value in the treatment of scrofula, convalescence, anæmia, &c. It is likewise a good summer resort for milk and whey 'cures.' Kreuth lies in a sheltered position amidst beautiful woodland mountain scenery, between the Tegernsee and the Achensee, $2\frac{1}{2}$ hours distant from the railway station of Gmund-am-Tegernsee. The Kreuzquelle, a cold weakly mineralised earthy spring, containing a little sulphuretted hydrogen, is used for drinking and bathing. The season is June 1 to September 15.

Heilbrunn, in the Bavarian Mountains, is a village situated at an altitude of 2,620 feet, $1\frac{1}{2}$ hours distant from the railway station at Tölz. At Heilbrunn is the Adelheidsquelle, a cold muriated spring, containing, according to E. Egger (1881), 4.9 per mille common salt, 0.9 per mille bicarbonate of sodium, 0.05 per mille bromide of sodium, and 0.03 per mille iodide of sodium. Of German muriated waters this is the richest in bromine and iodine; but it is doubtful whether these substances are present in sufficient amount to exercise any decided therapeutic effect.

Amongst German muriated waters, containing under 15 per mille common salt, the following have not yet been mentioned:

SULZBRUNN, in Upper Bavaria, near the village of Sulzberg, at an altitude of 2,800 feet [the Römerquelle, according to Liebig, contains about 2 per mille common salt and 0.015 iodide of magnesium]; **NEUHAUS IN BAVARIA**, at the foot of the Salzburg, in the Valley of the Saale (9 to 15 per mille common salt); **SULZBAD** (French, SOULTZ-LES-BAINS) and **KESTENHOLZ** (French,

CHÂTENOIS), in Alsace (3·2 per mille common salt in their waters) ; GANDERSHEIM, in the Duchy of Brunswick (springs contain up to 13·7 per mille common salt) ; WERL, in Westphalia (12·3 per mille common salt) ; and KÖNIGSDORFF-JASTRZEMB, in Prussian Silesia (11 per mille common salt, with a little bromide and iodide of magnesium).

Other German 'Soolbäder,' with brines of various strengths (above 15 per mille common salt), are : ADMIRALSGARTEN-BAD and other springs, in BERLIN ; SALZDETfurTH, in Hanover ; CAMMIN and the University town of GREIFSWALD (both close to the Baltic coast), in Pomerania ; ORB and SODEN-STOLZENBERG, in the Prussian Province of Hesse-Nassau ; SUDERODE, ARTERN, and DÜRRENBURG, in Prussian Saxony ; GOCZALKOWITZ, in Prussian Silesia ; WIMPFEN, on the Neckar, in Hesse-Darmstadt. BERNBURG, on the Saale, in the Duchy of Anhalt, has an extremely concentrated brine, practically a saturated solution (31 per cent.) of common salt, like the brines of Rheinfelden, in Switzerland, and Droitwich, in England.

Ischl, in Austria (Salzkammergut), a station on the railway between Gmunden and Aussee, lies in a broad fertile valley at the junction of the Traun and the Ischl, about 1,550 feet above sea-level. Some of the houses on the surrounding slopes have a fresher air than the principal part of the town, which is built in a lower position on the banks of the Traun, almost completely sheltered on every side by mountains.

The strong Ischl brine, containing $23\frac{1}{2}$ per cent. common salt, with a total of $24\frac{1}{2}$ per cent. solids, is used for baths. The 'Schwefelquelle' contains, in addition to 17 per mille common salt, 4 per mille sulphate of sodium and a little sulphuretted hydrogen. The Klebelsberg-Quelle and the Marie-Louisen-Quelle, containing about 5 per mille common salt, are used for drinking, and the most important mineral waters of other spas can be obtained at the 'Trinkhalle.' The indications for a course at Ischl are the ordinary ones for muriated waters and strong brine baths.

Mud baths ('Salz-Schwefelschlamm-bäder'), pine baths, and hydrotherapeutic treatment can be obtained. Ischl is likewise, on account of its numerous admirably laid out walks in the shady pine forests and surrounding slopes, well adapted for treatment by graduated walking exercise, the so-called 'Terrain-Cur.'

Owing to the beauty of the surroundings and good accommodation many persons visit Ischl more as a climatic health resort and place of recreation than on account of the waters. In many cases Ischl is suitable for an after-cure to active mineral water treatment. Milk and whey cures can also be arranged. The

spa is much visited by Austrians. The season is from June to September, but accommodation can be obtained earlier and later.

Gmunden, in Austria, the chief town of the Salzkammergut, lies at an altitude of 1,390 feet, on the beautiful Traun See, and is a station on the railway between Attnang and Ischl. A 24 per cent. brine from the Ebensee salt works is used at Gmunden for bathing. There is apparatus for artificial aëro-therapeutic treatment. Season, June to the end of September.

Aussee, a very popular summer health resort in Styria, close to the Salzkammergut, is pleasantly situated at an altitude of 2,150 feet, in a broad fertile valley, sheltered on all sides by the surrounding mountains. It possesses a 25 per cent. brine, used for bathing. Both the brine and the 'Mutterlauge' are employed in a diluted form internally. The railway station is 20 minutes distant. The season is May 15 to October 1, but there is likewise accommodation to be had during winter. The summer resort of ALT-AUSSEE is about 3 miles distant.

Hall in Tirol (Austria), seven miles east of Innsbruck, is an old-fashioned town, situated in the lower Inn Valley, at an altitude of 1,835 feet. It is a station on the Munich and Innsbruck railway, and is likewise connected with Innsbruck by a local steam tram line. The baths in the neighbourhood are supplied with a 24 per cent. brine, conducted from the Salzberg, about 6 miles distant. In the neighbouring village of Heiligenkreuz are a chalybeate spring and a weak sulphur spring. The season is from May 15 to September 30.

Hallein (altitude 1,450 feet), an Austrian summer health resort on the left bank of the Salzach, 11 miles south of Salzburg, has noted brines and arrangements for brine baths. The station is on the railway running south from Salzburg.

Hall in Upper Austria.—Bad Hall (altitude 1,230 feet) has a station on a branch line of the Kremsthal railway. It is celebrated for the muriated water of the Tassilloquelle, which according to E. von Ludwig (1893) contains 12 per mille chloride of sodium, with 0.081 per mille bromide of magnesium and 0.028 per mille iodide of magnesium. This water, which is exported as the 'Haller Iodwasser,' was anciently known as the 'Haller Kropfwasser.' The exact therapeutic value of the iodide and bromide in the water remains doubtful. There are likewise other salt springs. This spa is used for scrofulous and rickety children, for the treatment of syphilis, and for some gynecological affections. There is a hospital for scrofulous children, founded in 1855, a small sanatorium for poor adults, and a military sanatorium. The season is from May 15 to September 30. The bath salt extracted from the water contains 14.3 per mille chloride of

calcium, 2·6 per mille iodide of magnesium, and 3·2 bromide of magnesium.

Darkau or **Iodbad-Darkau**, pleasantly situated in Austrian Silesia not far from Teschen, has iodide and bromide-containing common salt waters, used for baths in scrofulous children, syphilitic cases &c. The Darkau springs¹ contain 21·6 per mille common salt, 1·8 per mille calcium chloride, 2·8 per mille potassium chloride, 1·17 per mille magnesium bromide, and 0·04 per mille magnesium iodide. The health resort itself lies in a large park. The salts from the springs are exported.

Ivonicz or **Ivonitch** (Galicia) in the Carpathians, at an altitude of 1,340 feet, possesses two gaseous muriated springs, the Karls-Quelle and the Amalien-Quelle (about 8 per mille common salt), which contain a little sodium carbonate (about 1·7 per mille) with iodide of sodium (about 0·016 per mille); the first spring contains 0·023 per mille bromide of sodium. There are likewise chalybeate and naphtha springs, the last of which is used for inhalation. Peat and mud baths are employed. The railway station is $7\frac{1}{2}$ miles from the establishment.

Hercules-Bad, near MEHADIA, in Hungary. The 'Hercules spring' yields an unusually large quantity of thermal muriated water (temperature variable, 70° to 133° F.), containing 1·5 per mille common salt and about half as much calcium chloride. It is free from sulphuretted hydrogen; but most of the springs are sulphurous (see Chapter XXV).

Csiz, in Upper Hungary, in Comitát Gömör, three-quarters of a mile from the railway station. According to the analysis of Professor E. Ludwig, of Vienna, in 1890, the Hygieaequelle, the only one used for drinking, is a cold muriated water containing 18 per mille common salt, 0·14 per mille bromide of magnesium, and 0·04 per mille iodide of magnesium.

Vizakna, or in German, **Salzburg**, in Transylvania (altitude 1,590 feet), possesses brines of different strengths (from 5 to 15 per cent.), containing from 0·8 to 0·25 per mille iodide of sodium.

Baassen (altitude 630 feet), picturesquely situated in Transylvania, 8 miles from the railway station of Mediasch, possesses muriated springs (temperature 54° to 59° F.), containing minute quantities of iodide and bromide of sodium, and rich in carbonic acid gas. The Felsen-Quelle contains 4 per cent. common salt, 0·03 per mille bromide of sodium, and 0·013 per mille iodide of sodium.

Rheinfelden (Switzerland) is an ancient town pleasantly

¹ See Victor Klimek, 'Die Skrophulose und deren Behandlung, mit besondere Berücksichtigung der Iodsolbädertherapie,' *Berliner klinische Wochenschrift*, 9 April 1906, p. 465. Redtenbacher's analysis (1869) gave 21·9 common salt, 2·1 calcium chloride, 0·2 potassium chloride, 0·1 magnesium bromide, 0·03 magnesium iodide.

situated (altitude 866 feet) in Canton Aargau. It lies on the left bank of the Rhine, 9 miles above Basel, in the broad part of the Rhine Valley, bounded by the Black Forest on the north, and the Jura Mountains on the south. The climate is mild and in summer rather warm, but the neighbouring forests and the stream impart freshness to it.

Rheinfelden, like Droitwich in England, possesses one of the strongest possible brines. According to the analysis of Professor Bolley in 1868 its brine ('Soole') contained a total of 264 per mille solids (258 per mille being common salt), and its specific gravity taken at 57° F. was 1.205. Treadwell's analysis of 1898 makes the total solids 257 per mille, 252 per mille being common salt and 3.9 per mille calcium sulphate. Amongst other salts Treadwell has detected small quantities of the chlorides of potassium, lithium, ammonium, and aluminium, sodium sulphate, sodium silicate, sodium borate, magnesium bromide, strontium sulphate, and carbonate of iron. He finds the specific gravity 1.199. The Rheinfelden brine is therefore practically a saturated solution of common salt. The 'Mutterlauge' has been said to contain 31 per cent. common salt, with about 3 per mille chloride of magnesium and 2 per mille chloride of calcium, and therefore differs from the original 'Soole' much less than the 'Mutterlauge' obtained from weaker muriated waters do.

The Rheinfelden treatment consists chiefly in brine baths and douches, and Dr. Keller and others have shown that concentrated brine can in a large number of cases be used for this purpose without producing excessive irritation. Hydrotherapeutics and massage are likewise made use of when required. Sometimes local applications by a towel wrung out of the 'Soole' or 'Mutterlauge' are ordered, and occasionally the brine is taken internally in a very diluted form.

The baths are suitable in many anæmic and cachectic conditions, which require stimulating treatment, in scrofulous children and in patients of the pasty lymphatic type. According to A. Robin of Paris and Keller of Rheinfelden, brine baths are suitable in those cases of chlorosis where an examination of the metabolism shows that the processes of oxidation in the body are incomplete and that the nitrogenous materials are not sufficiently made use of. Rheinfelden may be of service likewise in cases of prolonged convalescence, in cases where there are remains of old pleuritic inflammation, and in many chronic rheumatic affections. The season is from May to the end of October. There is first-class hotel accommodation on the river side above the town. For poor patients there is a well-managed hospital close to a forest, where the patients can remain most of the time in the open air.

The railway station is on the line between Basel and Zürich (express trains stop).

Schweizerhalle (Switzerland), in the Canton of Basel, situated on the left bank of the Rhine, at an elevation of 900 feet above the sea, is about 20 minutes' drive from the railway station of Pratteln. Its strong brine is practically saturated like that of Rheinfelden.

The interesting old towns of SAECKINGEN and LAUFENBURG on the Rhine (the former on the right or German bank), between Rheinfelden and Waldshut, also possess 'Soolbäder.'

Bex (Switzerland, Canton Vaud) is a climatic health resort situated at an altitude of about 1,400 feet on the right side of the broad Rhone Valley, 11 miles from the eastern end of the Lake of Geneva. The position is almost completely sheltered by mountains, and commands a magnificent view of the Dent du Midi, which towers above the opposite side of the valley. The cold brine of Bex according to Brunner's analysis (1894) contains 27 per cent. common salt, 2 per cent. chloride of calcium, with about 1 per cent. chloride of magnesium; the total solids is 31 per cent. The 'eau-mère' (total solids 33 per cent.) contains according to Brunner 25 per cent. common salt, 4 per cent. chloride of magnesium, and about 2 per cent. chloride of potassium; it is often used for baths in combination with the brine, and after filtration and dilution is sometimes used internally at Bex, as well as at the neighbouring spa of Lavey. The cold muriated sulphur spring is not much used. The salt water when artificially aerated with carbonic acid gas (by the help of the Kiefer-Fischer apparatus)¹ is employed at the Grand Hôtel des Salines for artificial gaseous baths like those of Nauheim. There are arrangements at Bex for hydrotherapeutics and massage. Bex is a good locality for grape-cures, and milk or whey cures can be arranged.

The patients most treated here are delicate women, requiring tonic treatment, scrofulous children, patients with a tendency to pulmonary catarrhs, &c. The daily fluctuations in temperature are somewhat greater than those at Montreux and other localities on the Lake of Geneva, but it is very hot in summer. The season lasts from March to the end of October; the best months are May and June, and from the end of August to the end of September. The fine Hôtel des Salines stands in a park away from the town and somewhat further from the railway station, which is on the line between Lausanne and Brieg.

¹ See E. de la Harpe, *Annalen der Schweizerischen Balneologischen Gesellschaft*, Aarau, 1905, vol. i. p. 69.

Wildeggen (Switzerland, Canton Aargau) is pleasantly situated in the Valley of the Aar, about $2\frac{1}{2}$ miles to the south of the spa of Schinznach (Chapter XXV). Its cold muriated water (10 per mille common salt, 1·6 per mille chloride of magnesium, 1·8 per mille sulphate of calcium) contains iodide of sodium (0·028 per mille) and bromide of sodium (0·013 per mille). This water is employed at the neighbouring spa of Schinznach in scrofulous affections &c. and is exported.

Chatel-Guyon (France, Puy-de-Dôme) has sometimes been called the 'French Kissingen' and deserves mention in the present chapter, but for the description of the spa we shall refer readers to the muriated alkaline group of mineral waters (Chapter XX).

Bourbon-l'Archambault (France, Department of Allier).—This spa was once very famous owing to the residence of Madame de Montespan and the visits of Catherine de' Medici, the Princes de Condé, Madame de Sévigné, Madame de Maintenon, Racine, Boileau, &c., and, in later times, Prince Talleyrand. The town (altitude 870 feet), dominated by the picturesque ruins of its ancient castle, is situated on hilly ground about 16 miles to the west of Moulins.

The thermal muriated water (temperature 126° F.), of which there is an abundant supply, according to Willm's analysis, has a total mineralisation of 3·1 per mille, including 1·7 per mille common salt, 0·4 per mille carbonate of sodium, 0·2 per mille carbonate of calcium, and a minute amount of iron. According to the earlier analysis of Ossian Henry the amount of common salt was 2·2 per mille. The thermal water is used at the temperature required, for drinking, baths, douches, and swimming baths.

The 'Source Jonas' is a cold, weakly mineralised, slightly chalybeate spring (total mineralisation according to Willm is 1·49 per mille), and is said to have a certain laxative and diuretic action. It is sometimes taken pure or mixed with wine at meal times. A more agreeable table water, much used at this spa, is the gaseous weak alkaline earthy Source SAINT-PARDOUX (bottled at the spring nine miles distant) containing a small amount of iron. According to Willm its total mineralisation is only 0·15 per mille. The spring of LA TROLLIÈRE, not far from that of Saint-Pardoux, is also sometimes made use of. Its water is similar to that of the latter spring, but contains a variable quantity of sulphuretted hydrogen, an ingredient not present in the water of Saint-Pardoux.

Bourbon-l'Archambault has a fine thermal establishment; it likewise possesses two hospitals, one for persons unable to pay,

the other for patients sent by the military authorities. The affections treated here include various forms of chronic rheumatism and nervous affections. This spa has a certain old reputation for benefits obtained in cases of paralysis due to cerebral hæmorrhage, but fewer cases are sent here now that the pathology of these conditions is better understood. According, however, to Dr. Regnault the thermal treatment does no harm in such cases, and may often do some good. Dr. Regnault mentions good results obtained in cases of arthritis deformans of rapid onset in young persons. As adjuvants to the thermal treatment, massage and a sort of dry cupping are often employed. For the dry cupping, instead of ordinary cupping glasses, small horns are employed with a hole pierced at their ends. Special attendants apply them to the skin, suck out the air, and then close the hole with wax. Local hot vapour baths are found of great utility in chronic articular affections &c.¹

The season is May 15 to September 15. The railway station is on the line from Moulins to Cosne-sur-l'Ère, 1 hour from Moulins.

Bourbon-Lancy (France, Department of Saône-et-Loire).—The spa (altitude 780 feet) lies in a shallow valley to the west of and under the old town, about 31 miles to the east of Moulins. It was known to the Romans, and became famous through the visit in 1542 of Queen Catherine de' Medici.

Its thermal muriated springs (temperature 82.4°–136.4° F.) are all weakly mineralised, approaching the simple thermal group in character. According to the analyses of Tellier and Laporte in 1858 and of F. Glénard in 1881 the different springs resemble each other in their chemical constituents. The Source de la Reine, which may be taken as a type of the Bourbon-Lancy waters, has, according to Glénard, a total mineralisation of 1.82 per mille, and contains 1.29 per mille common salt. The waters can therefore hardly be compared, as they have been compared, to the Wiesbaden waters, which contain about 7 per mille common salt. One of the Bourbon-Lancy springs has a slight smell of sulphuretted hydrogen. According to Dr. A. Piatot, of Bourbon-Lancy, the least mineralised of the springs have been found to show the greatest amount of radio-activity.

The thermal establishment is provided with baths, douches, apparatus for pulverisation, hot vapour chambers, and a swimming bath. The douches are sometimes applied to the affected part beneath the water of the bath (the 'submarine douche' as

¹ See Dr. H. Bernard, 'Les Etuves Partielles de Bourbon-l'Archambault et leurs Indications,' *Annales d'Hydrologie*, Paris, August 1904, vol. ix. p. 273.

de Bosia terms it) so that their force is somewhat broken (cf. the 'submarine' or 'under water' douches of Plombières, known in England as 'Tivoli' douches).

The affections treated at Bourbon-Lancy include chronic rheumatism, chronic nervous disorders, and some chronic valvular and other cardiac complaints.¹ Patients can lodge in rooms at the thermal establishment if they prefer it to living in hotels. Poor persons receive thermal treatment gratuitously at the Hospice d'Aligre.

The 'Source de la Reine,' bottled after the addition of carbonic acid gas, is sometimes used here as a table water.

The season is May 15 to September 15. The railway station is on the line between Gilly and Cercy-la-Tour, and about 1½ miles distant from the spa.

Bourbonne-les-Bains (France, Department of Haute-Marne). Bourbonne is a small town pleasantly situated (altitude about 900 feet) on hilly ground belonging to the Monts Faucilles, a small chain connected with the Vosges Mountains. Owing to its position in relation to mountains and forests it has a good deal of rain for this part of France.

The thermal waters have a temperature of 109° to 150° F., and according to the analysis (1881) of Willm and Würtz they contain 5·2 per mille common salt, 1·3 per mille sulphate of calcium, 0·08 per mille chloride of lithium, 0·06 per mille bromide of sodium, and minute quantities of iron and manganese. Unlike the waters of Wiesbaden they are practically non-gaseous.

The waters are employed both internally and externally. Two or three glasses (each containing about a quarter litre) form the average daily dose for adult patients, and are taken either hot or cold.

Externally the water is chiefly employed for hot baths and douches. The douches (5–10 minutes) are generally given with the patient reclining; the pressure is considerable, so that a mechanical effect is produced, although manual massage is not applied together with the douche, as at Aix-les-Bains. The douches are employed in chronic rheumatoid arthritis, sciatica, neuralgias, &c., and are specially directed to the affected parts of the body. Similar treatment is employed for the various results of old injuries to bones and joints. Massage is given separately if required.

Besides rheumatoid arthritis, scrofulous conditions in children, and chronic affections of the pelvic organs in women are much treated at Bourbonne. The thermal baths have also, like those

¹ In regard to the forms of cardiac trouble most suitable for treatment at Bourbon-Lancy, see Dr. J. McGregor Robertson, 'A French Rival to Nauheim,' *Brit. Med. Journal*, August 15, 1903, p. 366.

of Barèges, an old reputation for the healing of wounds and chronic ulcers. In addition to the civil baths there is a most excellent establishment for thermal treatment attached to the military hospital. The season is from May to the middle of October.

In the neighbourhood are two cold weakly mineralised earthy springs, the Source BAYARD (LARIVIÈRE-SOUS-AIGREMONT) and the Source MAYNARD. Both have a total solids of about 2·6 per mille, and are non-gaseous; the former contains a little iron. They are used as table waters or otherwise at Bourbonne, and are supposed to have a special action analogous to that of Contrexéville waters in urinary affections.

Bourbonne-les-Bains is the terminus of a small branch railway from Vitrey, a station on the railway between Chaumont and Vesoul.

La-Mouillère-Besançon (France, Department of Doubs).—La Mouillère (altitude 830 feet), a suburb of Besançon, possesses a new bath establishment, founded in 1892, supplied by an underground conduit with the very strong brine from Miserey, a station on the railway $3\frac{1}{2}$ miles from Besançon. According to the analysis of Boisson and E. Baudin, the brine contains 283 per mille of common salt, 4 per mille calcium chloride, 2·4 magnesium chloride, 6·7 sodium sulphate, 0·1 bromide of potassium and traces of iodides (total mineralisation 298 per mille). The 'eau-mère' contains 234 per mille common salt, together with 73 per mille of other chlorides, 12 per mille sodium sulphate, and 2·2 per mille bromide of potassium. The water and eau-mère are employed for external use. There are likewise arrangements for ordinary hydrotherapeutic and electrotherapeutic treatment, and for artificial sulphur baths and muriated sulphur baths ('artificial Uriage baths'). A new first-class hotel and a casino adjoin the establishment.

Salins (France, Department of Jura).—Salins (altitude 1,200 feet) is a town picturesquely situated on the stream Furieuse, in the midst of the Jura Mountains. Lofty fort-crowned hills rise above the town on either side. It possesses cold muriated waters containing, according to Réveil, 22 per mille common salt, 0·03 per mille bromide of potassium, and traces of iodide of sodium. The waters are chiefly used for baths and douches; when used for drinking they are diluted and sweetened with a syrup. The baths are sometimes strengthened with the 'eau-mère,' which contains, according to Réveil, 16 per cent. common salt, 6 per cent. chloride of magnesium, 8 per cent. sulphates of sodium and potassium, and 2·8 per mille bromide of potassium. There are small brine swimming baths suitable for children. Salins is a

spa for scrofulous and rickety children, convalescents, women with leucorrhœa &c. It is the terminus of a branch line from Mouchard on the railway from Dijon to Pontarlier. The establishment and hotel connected with it (which adjoin some interesting ancient salt-works or *salines*) are open from June to October. In the neighbourhood are numbers of pleasant excursions, especially suitable for those who can walk uphill.

Lons-le-Saunier (France, Department of Jura) is a town of moderate size, pleasantly situated at an altitude of about 840 feet in a broad hilly valley on the outskirts of the Jura Mountains. The railway station is on the line between Besançon and Lyons. At one end of the town is a recently erected bath establishment, with brine baths, hydrotherapeutic appliances, and small swimming baths of salt water. The brine, obtained from the Salines of Perrigny, is one of the strongest, after those of Droitwich and Rheinfelden; it has 305 per mille common salt, with a total mineralisation of 319 per mille. The 'eau-mère,' with a total mineralisation of 370 per mille, contains 6·9 per mille bromides. There is likewise a chalybeate muriated water, obtained from a spring called the Puits-Salé; it is suitable for drinking, and contains 10 per mille common salt, 1·1 chloride of magnesium, 1·6 carbonate of magnesium, 0·09 carbonate of iron, with a moderate amount of carbonic acid gas, and a trace of sulphuretted hydrogen.

Salins-Moutiers (France, Savoy).—This spa has been, for convenience, described with its neighbour Brides-les-Bains ('Brides-Salins') in Chapter XXII.

Uriage (France, Department of Isère) is described in the sulphurous group. (See Chapter XXV.)

La-Motte-les-Bains (France, Isère) is situated in a pleasant Dauphiné valley at an elevation of 2,130 feet above sea-level. The railway station, which is a little higher than the establishment, is 23 miles from Grenoble on the line to La Mure. The two very hot muriated springs (124° and 137·5° F.) rise a short distance from the baths; they contain about 3 per mille common salt, about 1·3 per mille sulphate of calcium, and 0·02 per mille bromide of sodium.

The waters are used internally and externally. Their chief use is in the form of baths and douches for chronic and painful rheumatic affections, sciatica and neuralgias, and in various chronic affections of the female pelvic organs. The thermal establishment, which is likewise an hotel (an old château transformed), is open from June to September.

Salies-de-Béarn (France, Department of Basses-Pyrénées) has a railway station $\frac{1}{4}$ hour from Puyoo, a junction of the railway

between Toulouse and Bayonne, 33 miles east of Bayonne. Its 'Fontaine Bayaa,' according to O. Henry, contains rather more common salt than the brine of Nantwich in England, that is, about 21 per cent., but a more recent analysis gives it 25½ per cent. The two 'Oraas' wells, containing as much or more common salt, are situated about 3 miles off and are specially employed for the extraction of salt for commercial purposes. The 'eau-mère' contains, according to Garrigou, about 22 per cent. common salt, 15 per cent. chloride of magnesium, 5 per cent. chloride of potassium, and 1 per cent. of bromides.

Salies-de-Béarn (altitude 100 feet) has a mild climate, very hot in summer, and is open the whole year. Its water can be used for the affections usually treated by brine baths. Like the muriated baths of Kreuznach the baths of Salies-de-Béarn have a reputation in chronic inflammatory conditions of the female pelvic organs. They promote the absorption of the products of previous inflammation (perimetritis, parametritis, &c.), and they diminish the congestive troubles connected with fibromyomata of the uterus.

Biarritz (Department Basses-Pyrénées), the fashionable marine spa and winter resort of the south-western coast of France, possesses baths supplied by the strong brine springs of BRISCOUS, which contain about 29 per cent. common salt. The 'eau-mère' is likewise employed for baths, and is especially rich in chloride of magnesium. The water is heated to the temperature required for baths and douches. The bath establishment is about 10 minutes' walk from Biarritz, on the steam tramcar line between Biarritz and Bayonne, and is connected by a covered gallery with the large hotel on the opposite side of the road.

Dax (France, Landes) is supplied with brine and 'eau-mère,' similar in composition to those of Briscous. This resort has already been described in Chapter XVII.

Salies-du-Salat (France, Haute-Garonne) lies at an altitude of 960 feet, on the left bank of the Salat stream. The village has a railway station on the branch line between Boussens and Saint-Girons. The cold muriated water contains 30 per mille common salt and 3 per mille sulphate of calcium. There is likewise a cold sulphurous spring, containing, according to Filhol, 0.11 per mille sulphide of calcium. A sanatorium is devoted to children sent from the hospital of Toulouse.

Balaruc (France, Hérault) stands at about sea-level, on the salt Etang de Thau, which separates it on the south from the Mediterranean port of Cette. It possesses three common salt springs, whose temperatures are respectively 54°, 66°, and 118° F. The 'Source des Romains,' or 'Source Ancienne,' is the hottest, and contains about 7 per mille chloride of sodium. The waters

are used for drinking, and for baths and douches, in scrofulous and rheumatic affections. The 'eau-mère' of Villeroy is sometimes added to strengthen the action of the baths. Local mud baths are also used. Balaruc has an old reputation in torpid nervous affections; but comparatively few organic nervous cases are now sent thither for spa-treatment. The spa is reached from Cette by train (6 miles), by steamer, or by road.

Roucas-Blanc (France, Bouches-du-Rhône).—This establishment is on the coast, 2 miles to the east of the harbour of Marseilles, and possesses a muriated spring (temperature 70° F.) containing 20 per mille common salt, 2 per mille chloride of magnesium, and about 2 per mille of the sulphates of sodium, magnesium, and calcium. It is connected by the Corniche tram line with Marseilles.

Amongst other French muriated waters, containing under 15 per mille common salt, are the following: D'ECHAILLON, in Department Savoie (thermal, 3·6 per mille); PLAN-DE-PHAZY, in Department Hautes Alpes (4·6 per mille); POUILLON, in Department Landes, 6 miles from Dax (10 per mille).

Abano, North Italy (Province of Venice).—Abano (altitude 100 feet), a few miles by rail from Padua, lies not far from Battaglia, at the eastern foot of the isolated Euganean hills. The water of the thermal springs (temperature 100° to 183° F.), according to R. Nasini's analysis of 1894, contains 3·4 per mille common salt and about 1 per mille sulphate of calcium, and so little sulphuretted hydrogen that it can hardly be classified amongst the sulphur waters. Protococcus and other primitive forms of plant life grow in the water. Abano was well known as Aponi Fons or Aquæ Aponenses or Aquæ Patavinæ in Roman times, and in the sixth century Theodoric the Great ordered the baths to be restored.

Besides thermal mineral water baths, a mud ('fango'), rich in organic material and impregnated with the salts of the mineral waters, is employed, as at Acqui and Battaglia, in the form of hot local applications. Amongst the affections treated are rheumatoid arthritis, chronic rheumatic and gouty troubles and neuroses. The waters can be obtained also in Venice. The season is June 1 to September 30. Abano possesses a mild winter climate.

The neighbouring 'Euganean thermæ,' MONTLEGROTO (possibly mons aegrotans or mons aegrotorum, but not connected with the word 'grotto,' as the name, when written 'Monte Grotto,' suggests), SAN-PIETRO-MONTAGNONE, and MONTE ORTONE, have very hot waters, similar to those of Abano, but slightly less mineralised. The waters of Battaglia, the least mineralised of the group, have been classified in the simple thermal group (Chapter XVII). The radio-activity of the waters of Abano and

Battaglia has been recently investigated (see Chapters XIII and XIV). The 'fango' of Montegrotto, like that of Battaglia, can be obtained for baths in England.

Sales and Salice and Rivanazzano, in the Province of Pavia, not far from the railway station of Voghera, possess muriated waters and bituminous springs.

Salsomaggiore (Province of Parma) is about 5 English miles (36 minutes by steam tramway) from Borgo-San-Donnino, a station on the railway between Piacenza and Parma. This much visited and popular Italian spa is situated in a shallow valley of the north-eastern declivity of the Apennines, 520 feet above sea-level. There are interesting excursions to be made in the neighbourhood,¹ and there is first-class hotel accommodation.

Its cold muriated water, according to A. Gilbertini's analysis of 1871, contains 131 per mille common salt, 13 per mille chloride of calcium, 4.9 per mille chloride of magnesium, 0.2 per mille bromide of magnesium, 0.06 per mille iodide of magnesium, and 3.7 per mille of a bituminous material. Nasini and Salvadori (1899), however, make the common salt 153 per mille, calcium chloride 15.8, magnesium chloride 5.5, magnesium bromide 0.3, magnesium iodide 0.06 (total solids, 178 per mille). The bituminous fluid is removed from the water for commercial purposes. The Mutterlauge (Italian, 'Acqua Madre'), which is much used for inhalation purposes, chiefly contains chloride of calcium (176 per mille) and chloride of magnesium (80 per mille), with the remaining, not precipitated, portion (44 per mille) of common salt.

The bath arrangements are satisfactory, but there is no good muriated water for internal use. Amongst cases likely to derive benefit from the treatment are many patients suffering from scrofulous affections, chronic gouty and rheumatic disorders, various debilitated conditions, &c. The season is from April to the end of October, but July and August are very hot for English visitors. The cold sulphur waters of Tabiano (*q.v.*) are only 2 miles from Salsomaggiore.

Montecatini (Province of Lucca).—This much frequented Italian spa (altitude 920 feet) is prettily situated in the Val di Nievole. It possesses several subthermal muriated springs (temperatures 70° to 88° F.), containing 4 to 18 per mille common salt. The Torretta, Tamerici and Olivo springs, besides common salt, contain respectively 1.7, 1.95, and 2.8 per mille sodium sulphate and minute quantities of magnesium sulphate. The Tettuccio spring, where the band plays in the early morning,

¹ See 'Salsomaggiore: its Waters and Baths,' by J. Harold and P. A. E. Richards, *Brit. Med. Journ.* 1898, vol. i. p. 443. See also J. J. Eyre, 'The Baths of Salsomaggiore,' *Treatment*, February 1903.

contains only 4·6 per mille common salt, 0·3 sodium sulphate, and 0·45 magnesium sulphate. By Italian doctors Montecatini is considered a kind of 'Italian Kissingen,' and probably, as at Kissingen, the chief treatment is internal, though the bathing establishment at the Torretta spring is good. As at Kissingen, moreover, the waters are much taken in the early morning, before breakfast, and generally have a decided effect on the action of the bowels. The Montecatini treatment is for chronic dyspeptic and catarrhal conditions of the alimentary canal, chronic rheumatic and gouty affections, habitual constipation, &c., especially in persons who are not of a robust constitution. The spa has a great reputation in Italy for disorders of the digestive organs, including the liver. Patients staying at Montecatini can likewise be treated at the neighbouring natural hot vapour baths of Monsummano (*q.v.*) for painful rheumatic affections, sciatica, &c. The season at Montecatini and Monsummano is from May to the end of September, the first portion (before the hottest time of the year) being the time generally preferred by foreigners. The railway station of Montecatini is not far from the junction of Pistoja, on the line between Florence and Pisa.

Riolo, in Italy (Province of Ravenna), possesses muriated as well as sulphurous waters. The spa is described in Chapter XXV.

Castro Caro, in Italy (Province of Firenze), is situated at an altitude of 460 feet, on the eastern side of the Apennines, 1 hour's drive from the railway station of Forlì; it possesses muriated waters containing iodides and bromides. According to Professor L. Guerri, the water of the 'Sorgente Magnani' contains 44 per mille common salt, 0·197 per mille iodide of magnesium, and 0·185 per mille bromide of magnesium. The accommodation is now excellent.

Castellammare-di-Stabia, **Pozzuoli**, and **Ischia** are classed amongst the muriated alkaline group (Chapter XX).

Termini-Imerese, on the northern coast of Sicily, the 'Thermæ Himerenses' of the Romans, possesses thermal muriated waters (temperature about 108·5° F.). According to Professor V. Oliveri of Palermo (1894) the north-east spring contains 11 per mille common salt, with minute quantities of other chlorides, sulphate of calcium, sulphate of magnesium, and 0·017 per mille bromide of magnesium (total solids, 14·6 per mille). The other spring (south-west) is rather more highly mineralised, and besides the common salt is said to contain 1·3 per mille chloride of magnesium and 1·5 sulphate of magnesium. The railway station is 23 English miles to the south-east of Palermo. The mean annual temperature at Termini is said to be 65·6° F. Though the thermal establishment is small, the place may become a useful health resort in the future, especially for arthritic invalids needing

thermal treatment during the winter months. But the winter climate is of course not so warm as that of Helouan, in Egypt, where the thermal establishment is very good.

Caldas-de-Montbuy (Spain, Province of Barcelona) lies at an altitude of 720 feet, in a situation sheltered from the north-east. The springs have temperatures of 122° to 158° F. and a total mineralisation of about 1 per mille (chiefly common salt). They may therefore be described as thermal weakly muriated, and are compared by Dr. A. Labat to those of Bourbon-Lancy in France, approaching the simple thermal group in character. They are of great local repute for chronic rheumatic affections, sciatica, and neuralgias, and are also resorted to for various forms of paralysis and for old wounds. The water of the 'Fuente del Leone' (158° F.) in the centre of the town is likewise used by the inhabitants for domestic purposes, like that of La Bollente at Acqui in Italy. The spa is 2 hours distant by carriage from the railway station of Mollet, and is closed during the extreme heat of summer.

Arnedillo (Spain, Province of Logrono) possesses thermal muriated waters (126·5° F.) with a total mineralisation of about 8 per mille.

Puente Viesgo (Spain, Province of Santander), in the Valley of Toranzo, has very weak muriated thermal waters (95° F.) with a total mineralisation of about 2 per mille. They are used in chronic rheumatism and in some cardiac cases.

Caldas-de-Besaya (Spain, Province of Santander) possesses weak muriated thermal waters (95° F.) with a total mineralisation of about 3 per mille.

Cestona-Guesalaga (Spain, Province of Guipuzcoa) possesses thermal muriated waters (95° F.) containing about 5 per mille common salt and about 2 per mille calcium sulphate.

Orduna (Spain, Province of Biscaya) possesses cold muriated waters with about 10 per mille common salt. It lies at an altitude of about 980 feet, and is on the railway between Bilbao and Miranda-de-Ebro.

Trillo (Spain, Province of Guadalajara) possesses muriated springs (77°–86° F.), containing about 4 per mille common salt. Some are slightly sulphurous.

Fortuna (Spain, Province of Murcia), about 12 miles from the town of Murcia, has thermal weak muriated waters (118° F.), used in chronic rheumatic affections, &c. Owing to the heat the season is interrupted during the months of July and August, as at the neighbouring baths of Archena.

Ciechocinek, in Russian Poland, 2 miles from the Prussian border, possesses muriated waters (18 to 44 per mille common

salt) and 'Gradirhäuser,' which can be used for inhalation. Mud baths are likewise employed.

Russia is rich in brines of various strengths, thanks to the salt lakes, 'limans' as they are called in Russia, which occur in considerable numbers near Odessa and in the Crimea, and along the whole northern shore of the Black Sea.

NOTE ON SEA WATER AND SEA-WATER BATHS

Sea water is a natural solution of sodium chloride and small quantities of other salts. According to Lersch, in the Red Sea and the Mediterranean the total salts may be estimated at 3·2 to 4·1 per cent., in the Atlantic Ocean at 3·0 to 3·7 per cent., in the North Sea at 3·1 to 3·4 per cent., in the Baltic at 0·7 to 1·9 per cent., and in the Black Sea at about 1·7 per cent. Though sodium chloride forms the chief part of the solid constituents of sea water (Mediterranean water contains about 3 per cent. sodium chloride, and North Sea water contains about $2\frac{1}{2}$ per cent.), analyses show that the composition of sea water is extremely complex. It contains more or less constantly measurable quantities of the chlorides of potassium, magnesium, and calcium, and of the sulphates and carbonates of magnesium and calcium. At all events near the coast it may contain minute quantities of bromine, iodine,¹ boron, and free sulphuric acid. Traces of gold,² arsenic, lead, zinc, copper, silver, strontium, caesium, and rubidium have likewise been found in sea water. It is scarcely radio-active.³

Sea water is a natural mineral water of the muriated or chloride class. In fact, according to Quinton and R. Simon, the various inland brines and common salt waters owe their mineralisation to their passage through underground salt beds of marine origin. It is therefore natural that sea-water baths (especially when not taken in the open air) act in the same way

¹ From the investigations of Armand Gautier (*Comptes Rendus de l'Académie des Sciences*, Paris, 1899, vol. cxxviii, pp. 643 and 1069) it appears that the greater part, if not the whole, of the iodine in sea water and in the air exists there in organic combinations, not in the form of alkaline iodides or other inorganic combinations. Gautier found the air over the open sea richest in iodine; and it is possible that both the iodine of the sea and that of the air are derived chiefly from living organisms.

² In regard to the possible importance of minute quantities of metals in mineral waters, W. Meyerhoffer has drawn attention to the fact that the proportion of gold in sea water is much greater than that of platinum in Bredig's fluids. On the question of 'mineral enzyme' action in mineral waters see Meyerhoffer, *Die chemisch-physikalische Beschaffenheit der Heilquellen*, Hamburg, 1902. As to the presence of gold in sea water, it has, we believe, been seriously suggested that the gold might be profitably extracted for commercial purposes!

³ The amount of radium in sea-salt is extremely minute as compared to the amount in the deposit from thermal springs at Bath. See Strutt, 'On the Distribution of Radium in the Earth's Crust,' *Proc. Roy. Soc.*, 1906, Series A, vol. 78, p. 151.

as the inland fairly strong salt or brine baths, called by the Germans 'Soolbäder.' There are, however, important differences between the bathing at 'Soolbäder' and bathing in the open sea. In sea bathing, or, as it often is, 'surf bathing,' there is the charm and freshness of bathing on the open sea-shore, and there is the mechanical effect on the skin of the alternate exposure of the body (or of part of the body) to air and to sea water, the effect of the movements of the air and the water, and the stimulation by the impact of waves sometimes carrying sand with them. This is absent in the Soolbäder (unless, indeed, the waves be to some extent artificially imitated); these rather resemble the taking of warmed sea-water baths in closed rooms, which is often preferable to open-air bathing in the case of weakly children and very delicate and timid people. The frequent impact of the water in bathing may induce or aggravate aural affections, and bathing in the open—at least if the ears are not protected—is generally to be avoided in cases of chronic disease and of tendency to catarrhal affections of the ear. Sea-bathing may aggravate an eczematous eruption or bring out an urticarial or other rash,¹ or in some cases may be followed by too great a feeling of fatigue, headache, sleeplessness, loss of appetite, dyspepsia, or loss of weight; in such cases it should be abstained from temporarily or permanently, or else baths of very short duration (always to be recommended at the commencement of a course) should be tried; or possibly baths of warmed sea water (similar to ordinary Soolbäder) taken in the house may be found suitable to begin with; there is further the alternative of a plunge and swim in a tepid sea-water swimming bath, and this constitutes a nearer approach to open-air sea-bathing than a warm sea-water bath at home. Even persons in fairly good health, but unaccustomed to sea bathing, should be recommended not to bathe in the open sea before breakfast without taking a little milk, or a cup of coffee and a biscuit first of all. This precaution must of course never be neglected by invalids, and bathing in the sea after a tiring walk should likewise be avoided.

The duration of a sea bath must depend on (1) the bather, whether he is strong or weak, and whether accustomed to sea-bathing or not; (2) on the temperature and movement of the water and the air. It must not be forgotten that on sunny calm days the temperature of shallow water near the shore may vary 7° F. or more in the course of the day, though in rough weather

¹ Skin eruptions from sea-bathing may be due sometimes not so much to the immediate action of the bath as to subsequent irritation caused by particles of salt left behind in the interstices of the epidermis after drying the body. A douche of ordinary fresh water after the sea-bath will help to remove the salt from the skin.

the daily range is much less, and on the surface of the open ocean it averages scarcely a degree Fahrenheit. In weak persons a dip of one minute's duration may be all that can be allowed, and in such subjects a bath of more than five minutes is seldom advisable; whereas strong persons, already accustomed to open-air bathing (whether in salt or fresh water), may remain in the sea a much longer time, but even for them it is questionable whether a bath of a quarter to half an hour's duration is not just as useful as the much longer ones which are frequently indulged in with impunity.

Internal use of sea water.—Although the internal administration of small doses of diluted sea water has been occasionally advocated and sometimes carried out with apparently good results,¹ the unpleasant taste is not likely to render the custom at all general or 'fashionable.' In regard to the recent employment of subcutaneous injections of isotonic (diluted) sea water by R. Quinton and others in tuberculosis &c., Quinton's various communications, especially 'L'Eau de Mer, Milieu organique,' published by Masson at Paris, the writings of F. Lalesque, of Arcachon, and the joint paper by R. Simon and R. Quinton (*Société de Thérapeutique*, Paris, Jan. 24, 1906) entitled, 'L'Eau de Mer, en Injections Isotoniques sous-cutanées, dans la Constipation, la Dysménorrhée, la Migraine, la Neurasthénie, isolées ou associées,' may all be consulted.²

Difference in sea waters and seasons for sea-bathing.—Though sea water is practically only used in the form of baths and douches (i.e. for external application), yet it makes some difference which sea water is used, for the amount of solids contained in water from the Baltic is less by half, and that from the Mediterranean is slightly greater than that from the German Ocean or Atlantic, which contains about 3 per cent. of common salt. Sea water from the Baltic is consequently less stimulating than from the Mediterranean or Atlantic. The water of the Mediterranean and Bay of Biscay is naturally warmer than that (during the bathing season about 60°–70° F.) near the shores of England and the neighbouring part of the Continent. The bathing season at the Mediterranean resorts lasts from May to November, but on the English Channel and North Sea only from June or July to September or sometimes October.

¹ See especially *A Dissertation on the Use of Sea Water*, translated from the Latin of Richard Russel, M.D., to which is added a translation of Dr. Speed's *Commentary on Sea Water*, fifth edition, London, 1769. See also A. P. Buchan's *Practical Observations concerning Sea-bathing*, London, 1804, p. 137, section on the internal use of sea water. The original Latin edition of Russel's book was published in London, 1755.

² See also Bousquet's review of the subject in the *Bulletin des Sciences Pharmaceutiques*, 1906, No. 8, p. 446.

CHAPTER XIX

SIMPLE ALKALINE WATERS

SIMPLE alkaline waters (see Chapter XIV) are often of use for dyspepsia in fairly robust subjects, especially when there is catarrh of the stomach and intestines. Prolonged courses of simple alkaline waters may, however, be harmful in catarrhal conditions of the digestive organs in weak persons when the gastric secretion is deficient in acidity, and in the ordinary 'atonic dyspepsia' of anæmia, chlorosis, and delayed convalescence. A. Bickel, whose experiments have already been referred to in Chapter XVIII, found that simple alkaline waters (Vichy) did not lower the specific secretory activity of the stomach as decidedly as might be expected from the action of sodium bicarbonate. This might be due to the antagonistic action of carbonic acid gas or to the presence of small quantities of various salts. Yet in organic disorders (e.g. catarrhal conditions) associated with diminished secretion and sub-acidity of the gastric juice, simple gaseous, muriated, or muriated-alkaline waters should be given the preference. Though emaciation is by no means a necessary result of the use of simple alkaline waters, one of the muriated-alkaline group is more suitable when loss of weight has specially to be avoided.

Simple alkaline waters exert a diuretic influence, and decidedly increase the solvent power of the urine for uric acid.¹ They are useful in at least some cases of gout, and gouty glycosuria, and the uric acid diathesis; in tendency to gallstones and 'abdominal plethora.' In respect to their effect on hepatic functions Mayo Robson² found that an aerated alkaline water increased the flow of bile more than several reputed cholagogues which he tried in the same case of biliary fistula; other experimenters, however, give different results. The action of these waters in obesity

¹ In this respect reference may be made to the interesting experiments of Drs. Schreiber and Zaudy with the Fachingen and Offenbach mineral waters (*Zeitschrift für diät. und. phys. Therapie*, Leipzig, 1898, vol. ii. p. 136).

² *Proceedings of the Royal Soc. London*, vol. xlvii. p. 505.

has been ascribed to the alkali combining with fat in the body to form soluble soaps, which are then excreted. This theory has not been confirmed, and the action of alkaline waters in obesity and glycosuria is probably due to the accompanying regulation of the diet, and to the general influence previously alluded to in the portion of Chapter XIV relating to the action of sodium carbonate.

Alkaline baths have a more cleansing action on the skin than plain water baths of the same temperature; when much carbonic acid gas is present they may exercise a mechanically stimulating action similar to that of baths of other gaseous waters. Warm alkaline baths, like most warm baths, are often useful in catarrhal conditions of the female pelvic organs.

Amongst the simple alkaline waters those of Vichy and Vals will be placed first as well-known types. The rest will be given afterwards in the political geographical order previously made use of.

Vichy (France, Department Allier).—Vichy, one of the most frequented spas of France, is situated (altitude 736 feet) on the right bank of the River Allier, amidst a rather flat cultivated country of somewhat uniform aspect. Its fame as a fashionable spa dates from about the time when Madame de Sévigné (1678) came to undergo the treatment and wrote such amusing letters about it. Vichy has an inland European climate resembling that of Paris.

The thermal alkaline waters of Vichy may be regarded as the representatives of the simple alkaline class. The different mineral springs of Vichy differ from each other chiefly in their temperature, in the proportion of free carbonic acid gas, and in the fact that some of them contain a mentionable amount of iron. Arseniate of sodium is found in traces (0·002 per mille in the 'Source Grande Grille'). It has been supposed that the various alkaline springs of Vichy and its neighbourhood have their source in a common deep subterranean reservoir, their differences in mineralisation and temperature being due to their passage through different strata and to the difference in the time they take to reach the surface.

The 'Grande Grille,' the best known of the Vichy springs, has a temperature of 108·5° F. and contains 4·8 per mille bicarbonate of sodium. The 'Source de l'Hôpital' has a temperature of only 89° F. and contains rather more carbonic acid gas and bicarbonate of sodium (5 per mille). The three 'Sources des Célestines' are all cold; the 'Source ancienne' contains about the same amount of carbonic acid gas and bicarbonate of sodium as the 'Hôpital' spring just mentioned, whereas the 'Source nouvelle,' and the

'Source de la Grotte' are characterised by containing respectively 0·044 and 0·028 per mille of bicarbonate of iron. The spring of 'Mesdames,' which is conducted from its source (near Cusset, about 2 miles distant) to the Etablissement des Bains at Vichy, resembles the two foregoing springs, and contains 0·026 per mille bicarbonate of iron. Amongst the other springs at Vichy the 'Puits Chomel' should be mentioned: it is very similar in temperature and constituents to the 'Grande Grille,' but is less rich in carbonic acid, and slightly richer in bicarbonate of sodium.

The patients treated at Vichy are mainly dyspeptics, and persons suffering from gall-stones, uric acid troubles, and various gouty, hepatic, urinary, and female pelvic disorders. Sufferers from chronic rheumatism often resort to this spa. All patients should have a certain amount of reserve strength, those with considerable cachexia of any kind being unsuited to Vichy treatment, a point especially to be considered in the case of gouty and diabetic patients.

The waters of Vichy taken in suitable doses have, as a rule, no laxative action like the sulphated alkaline waters of Marienbad, &c., but they are nevertheless used in the treatment of obesity; in such cases, of course, the diet is most important, though it was once supposed that the alkaline constituents of the Vichy water formed soluble soaps with the fats of the body, and thus favoured their removal by excretion.

In anæmic conditions the 'Source Mesdames' is the one generally preferred. The hot 'Grande Grille' has a special reputation in biliary calculi and hepatic complaints, the more strongly alkaline 'Source de l'Hôpital' being often preferred for gastric complaints (see the introductory part of this chapter), and the colder and more diuretic water of the 'Source ancienne des Célestins' for urinary affections. In recent times, however, this scheme of the uses of the different springs has been considered somewhat arbitrary, and the doctors do not always act according to it. The 'Puits Chomel' was mainly reserved for gargling &c. in cases of chronic pharyngitis and respiratory affections, but its use has been extended to cases formerly treated by one of the other hot springs of Vichy.

The Vichy waters are mostly taken at first in small doses, such as half a glass twice daily, and afterwards the dose is gradually increased to four or five glasses in the day; in former years much larger doses were given. The time preferred for taking the waters is an hour before or in some cases about two hours after meals; the more chalybeate Vichy waters ('Source Mesdames,' &c.) are often ordered to be drunk at meal times.

Baths are very much used at Vichy, in addition to the internal use of the waters. The large 'Etablissement des Bains' provides thermal mineral water baths, vapour baths, douches, and inhalation rooms. Besides the large establishment (first and second classes) there is a smaller one near the 'Source de l'Hôpital.' In addition to other hydrotherapeutic treatment, massage with douching has been adopted, somewhat after the method of Aix-les-Bains, yet sufficiently modified to be regarded as a distinctive feature of Vichy. The treatment is applied, not in the sitting position as at Aix, but with the patient reclining on a table so that his muscles are better relaxed for the application of the massage.

The mineral water of Vichy is likewise employed for perinæal, vaginal, and rectal ('ascending') douches. In specially severe gastric cases (with atony and dilatation), the stomach is periodically washed out by the ordinary syphon method.

Facilities are now provided at Vichy for Swedish gymnastics, for 'mechanotherapy' by Zander's appliances, for electric light baths, and for various forms of treatment by electricity.

There are several alkaline mineral springs in the neighbourhood of Vichy, amongst which the various springs of SAINT-YORRE, about 5 miles to the south of Vichy, may be specially mentioned; they are strong cold alkaline springs, belong to private owners, and their waters are used almost exclusively for exportation.

HAUTERIVE, $3\frac{1}{2}$ miles from Vichy, has cold alkaline waters used for exportation.

Near CUSSET, 2 miles only from Vichy, with which it is connected by electric tram, arises the 'Source Mesdames,' as already mentioned, the waters of which are conducted to Vichy. The place has likewise cold alkaline springs of its own: the 'Source Sainte Marie' (4.2 per mille bicarbonate of sodium), somewhat resembling the 'Mesdames,' but containing more iron and a little lithium; the 'Source Elisabeth,' containing 5.8 per mille bicarbonate of sodium; and the 'Source Andreau,' containing 4.6 bicarbonate of sodium, 0.019 bicarbonate of iron, and 0.01 arseniate of sodium. Cusset is further away from the river than Vichy, and the country around is somewhat more picturesque; it possesses a hydrotherapeutic establishment.

The alkaline waters of Vichy and its neighbourhood are largely exported and can be well used at home. The colder springs are better adapted for this purpose than the hot springs: those of Saint-Yorre, Hauterive, and Célestins may be specially mentioned.

The Vichy season lasts from May 15 to the end of September,

but the baths remain open all the year. For most invalids the middle of summer is unpleasantly hot at Vichy. On the subject of 'after-cures' the reader is referred to Chapter XXVIII.

Vals, in France (Department of Ardèche).—Vals is picturesquely situated at an altitude of 790 feet in a valley running from south to north. The spa lies on the banks of the Volane stream close to its junction with the Ardèche. Trees have been planted, and there is already a fair amount of shade around the springs for the patients to walk in. Pleasant excursions can be made in the district.

Vals has been called the 'Cold Vichy,' and is celebrated for its great number of cold alkaline springs, which are rich in carbonic acid gas, and contain from less than 1 to as much as 7 per mille bicarbonate of sodium, and small quantities of the bicarbonates of lithium, iron, &c. The different sources may be arranged in a series according to the degree of their alkalinity. Thus the more weakly mineralised of them, such as the Pauline, Délicieuse No. 1, Saint-Jean, and Impératrice, which have a total mineralisation of less than 3 per mille (not more than 1·7 per mille of bicarbonate of sodium), can be used as agreeable table waters. The Souveraine and Chloe springs have a higher mineralisation, that of the former being 3 per mille (2·5 per mille bicarbonate of sodium), that of the latter, 5·2 per mille (3·2 per mille bicarbonate of sodium). The 'Précieuse,' 'Désirée,' 'Rigolette,' 'Marquise,' and 'Magdeleine' springs are much more strongly alkaline, containing about 6·5 to 7·3 per mille bicarbonate of sodium with a total mineralisation of 7·5 to 8·9 per mille.

The 'Source Souveraine' contains 0·042 per mille bicarbonate of lithium. Some of the springs (as the 'Rigolette') contain a considerable quantity of bicarbonate of iron. The 'Vivaraise' spring No. 1, which has 0·05 per mille of the bicarbonates of iron and manganese, contains only 2 per mille of the bicarbonate of sodium.

The number of the alkaline springs at Vals is very great, and as at Saint-Yorre, near Vichy, a cold alkaline water can be obtained everywhere by sinking a well to a certain depth.

In the treatment of dyspepsia and cases of gastric catarrh (see introductory remarks to this chapter) &c. springs of different strength must be selected to suit the patient. The Rigolette water is artificially warmed at the source for the benefit of patients in whose case a thermal alkaline water, like those of Vichy, is desired.

The Etablissement Thermal is well provided with apparatus for baths and douches. Skilled massage may be obtained when advisable. There is an apparatus for supplying local douches of

carbonic acid gas collected from the mineral water. These gas douches are used in some chronic catarrhal conditions of the nose and pharynx : in some cases of vaginismus without obvious cause or associated with chronic inflammation of the cervix uteri, local gas douches are likewise said to be of service.

The sources 'Précieuse,' 'Magdeleine,' 'Rigolette,' and 'St. Jean' are those most frequently employed for use in England.

Besides its alkaline waters, Vals likewise possesses weak sulphate of iron and arsenical springs (see Chapter XXIV).

The season is from May 15 to October 15. The railway station (Vals-les-Bains and La Béguda) is on the branch line from Vogué to Nieigles-Prades, 3 miles beyond Aubenas.

Neuenahr, Germany (Rhenish Prussia).—This comparatively modern spa is much resorted to. It lies in a sheltered position in the valley on both banks of the Ahr, at an altitude of about 260 feet. In the middle of summer the heat is very great, and there are not the wooded walks in the neighbourhood which might be wished for. The waters are the only thermal simple alkaline waters in Germany; they are, however, much weaker than the similar waters of Vichy. The supply is abundant, amply sufficient for drinking purposes and for use in the large modern bathing establishment. The big 'Sprudel' (temperature 96° F.), according to R. Fresenius and E. Hintz (1894), contains 0.6 per mille carbonate of sodium, 0.2 per mille carbonate of calcium, 0.3 per mille carbonate of magnesium, 0.012 per mille carbonate of iron, minute quantities of arsenic and other substances, and a considerable quantity of free carbonic acid gas.

There is a room where patients with catarrhal conditions of the respiratory system may inhale the finely pulverised water as at Ems; a few cases of quiescent early chronic phthisis come here during the season, but the beneficial effect is doubtful. Chronic nephritic cases, dyspepsia with hyperacidity, and functional troubles of the nervous system (especially when allied with slight glycosuria), are treated here. The chief reputation of the spa is, however, in the treatment of troubles connected with the uric acid diathesis, and in cases of glycosuria. It hardly need be added that typical cases of diabetes in young persons are not likely to be cured here, or even to derive any permanent benefit from the treatment; the cases of so-called diabetes most likely to derive benefit being chronic cases in elderly persons, without wasting, especially when allied to gout or the uric acid diathesis. The season lasts from May to the commencement of October. Close to Neuenahr are the Apollinaris-Brunnen (mentioned in Chapter XXVII amongst simple gaseous and 'table' waters) and

other springs of the same class. Neuenahr is a station on the railway between Remagen and Altenahr.

Birresborn (Rhenish Prussia), a village with a railway station on the line from Cologne to Treves, has an alkaline gaseous spring with 2·8 per mille bicarbonate of sodium. Together with the bicarbonate of sodium, it contains a little bicarbonate of magnesium and sulphate of sodium, which impart a slight laxative effect, sometimes useful in acid dyspepsia with habitual constipation. It is often used as a table water.

Fachingen, in Prussia (Province of Hesse-Nassau), on the Lahn, between Ems and Limburg, possesses an alkaline spring rich in carbonic acid gas, and of about the same strength as the water of Bilin in Bohemia. Fachingen water contains, according to Fresenius, about 3·5 per mille bicarbonate of sodium. If used, therefore, as a 'table water,' it must not be expected to mix well with wine. The spring is the property of the Prussian State, and the water is only used for exportation.

Obersalzbrunn (or **Bad-Salzbrunn**) is the southern or upper part of the long straggling village of Salzbrunn in Prussian Silesia. It is situated in a shallow valley at an altitude of 1,320 feet, and has a station (the station of Bad-Salzbrunn is considerably nearer than that of Niedersalzbrunn) on the railway from Breslau to Halbstadt. Of its cold alkaline springs the chief one 'Oberbrunnen' contains, according to R. Fresenius (1882), 2·15 per mille bicarbonate of sodium, 0·01 bicarbonate of lithium, 0·4 sulphate of sodium, with 985 volumes of free carbonic acid gas to a thousand volumes of the water. The 'Mühlbrunnen' and other springs contain less bicarbonate of sodium. The 'Kronenquelle,' a spring in private hands, used chiefly for exportation, contains only 0·87 per mille bicarbonate of sodium, 0·01 bicarbonate of lithium, 0·7 bicarbonate of calcium, and 0·18 sulphate of sodium.

Though the waters of Salzbrunn are much more used for drinking than for bathing, a new establishment for baths and douches has been erected, and there are facilities for hydrotherapy and for active and passive movement-exercises by medico-mechanical appliances on the Zander system. There are likewise chambers for gargling, and a 'Pneumatisches Kabinet' with arrangements, as at Ems, for expiration into rarefied air and inspiration from air of increased density, a method of treatment for some cases of pulmonary emphysema and chronic bronchitis.

Salzbrunn is an excellent place for milk cures, &c. Special attention is devoted by the management to the purity of the milk supplied. Besides cow's milk, goat's, ass's, and sheep's milk can be

obtained, and also whey from either cow's or goat's milk, and kephir. Whey mixed with the mineral water (warm or cold), and whey or kephir (German, 'Eisenmolke,' 'Eisenkephyr') mixed with an iron preparation (for anæmic cases), are likewise much prescribed.

The spa is much resorted to by patients with chronic catarrhal affections of the respiratory organs, including some cases of quiescent or chronic pulmonary tuberculosis without fever. Amongst other indications for Salzbrunn are various chronic disorders of the digestive organs, the liver and the urinary organs, especially if connected with the 'uric acid diathesis.'

The shady paths in the adjoining fir plantation give opportunity for uphill walking exercise at various gradients. In the neighbourhood are the 'Wilhelmshöhe,' a magnificent point of view, and the romantic gorge called the 'Fürstensteiner Grund,' near Schloss Fürstenstein, and other attractions to encourage excursions of various length into the surrounding country. The season is May 1 to September 30.

Radein (altitude 660 feet), in Styria, possesses cold gaseous alkaline waters, which are exported as well as taken at the place itself. According to the 1894 analysis by A. F. Reibenschuh, they contain 3 per mille carbonate of sodium, 0.03 carbonate of lithium, and 0.01 carbonate of iron.

Gabernigg, in Styria, 2½ hours from Rohitch, possesses several gaseous alkaline waters, some of which are exported.

Bilin (650 feet), in Bohemia, near Teplitz, possesses the 'Biliner Sauerbrunn,' a cold gaseous alkaline spring, which, according to Gintl's analysis of 1893, contains 3.3 per mille carbonate of sodium, 0.66 sulphate of sodium and 0.24 sulphate of potassium (total solids 5.1 per mille).

It is used for chronic gastric catarrh, gouty complaints, uric acid gravel, and chronic bronchial catarrh. In some persons Bilin water acts as a gentle laxative, perhaps owing to the minute quantity of the mixed sulphates it contains. In gouty cases the cure may be commenced or continued at the neighbouring Teplitz. The water may be drunk pure or mixed with whey. The bath establishment possesses arrangements for hydrotherapeutic treatment. The season lasts from May 15 to the end of September.

The **Fellathalquellen**, in Carinthia (altitude 1,970 feet), about five hours distant from the railway station of Kühnsdorf, are gaseous alkaline springs, the waters of which, containing 4.3 per mille bicarbonate of sodium and 1.7 per mille bicarbonate of calcium, are exported.

Preblau (Carinthia) is pleasantly situated in the Lavant

Valley 3,280 feet above sea-level. Its cold gaseous alkaline waters, containing 2·2 per mille bicarbonate of sodium, are used at the place itself, and are likewise exported as table waters.

Szinye-Lipocz, near **Eperies**, in Hungary, possesses the 'Salvator' spring, the water of which is exported. It is a weakly mineralised cold gaseous alkaline water containing, according to Professor M. Ballo (1882), 0·3 per mille bicarbonate of sodium, 0·9 per mille bicarbonate of magnesium, 1·7 per mille bicarbonate of calcium, 0·09 per mille borate of sodium, and 0·02 per mille bicarbonate of lithium (total solids, 3·4 per mille). It has been recommended in the treatment of the uric acid diathesis, and in some urinary affections, &c. The Salvator water will be again mentioned amongst the simple gaseous group in Chapter XXVII.

Passugg (Switzerland, Canton Graubünden).—The establishment, about 1 hour distant to the south-east of Chur, lies at an altitude of 2,710 feet on the projecting eminence between the Rabiusa and the Plessur streams, just before their junction. Its cold gaseous alkaline springs contain, according to Planta, 1·9 to 5·6 per mille bicarbonate of sodium, 0·6 to 1 bicarbonate of calcium, and 0·01 bicarbonate of iron. Of these the comparatively weakly mineralised Theophilquelle, with a total solids of 3·9 per mille, might be used in some cases as a table water, whereas the Ulricusquelle contains more bicarbonate of sodium than the 'Grande Grille' at Vichy, and has, according to Planta, a total solids of 8·4 per mille. The cold gaseous alkaline earthy chalybeate 'Belvedra' spring contains, according to Husemann, 2 per mille bicarbonate of calcium, and 0·03 per mille bicarbonate of iron. The climate of Passugg must aid considerably in the treatment of anæmia and some kinds of dyspepsia. The season is from June to September.

Le Boulou, in France (Pyrénées-Orientales), is a village on the Tech River, at an altitude of 275 feet, about 1 mile from the railway station of Le Boulou-Perthus. It possesses simple alkaline waters rich in free carbonic acid gas (temperature 59°–68° F.). The waters, which are chiefly sent out for use at home, are employed in dyspeptic conditions &c. where simple alkaline waters are indicated. According to Willm (1883) the 'Source du Boulou' contains 3 per mille bicarbonate of sodium, 1·4 per mille bicarbonate of calcium, and 0·02 per mille bicarbonate of iron; the 'Source Clémentine' contains 5 per mille bicarbonate of sodium, 0·8 per mille bicarbonate of calcium, and 0·03 per mille bicarbonate of iron. Le Boulou is termed by Garrigou the 'Vichy of the Pyrenees.'

Châteauneuf, in France (Department of Puy-de-Dôme), lies at an altitude of 1,750 feet, on the River Sioule, in a deep valley

about 18 miles from Riom. It possesses weak alkaline waters having temperatures varying from 54° to 100.5° F. Some of the colder springs, notably the 'Source Morny,' contain a considerable amount of iron (0.05 per mille of the bicarbonate in the 'Source Morny'). Some of the warm springs are used for baths like simple thermal waters. The chalybeate 'Source Morny' is exported. Châteauneuf may be reached by diligence in about 4 hours from the railway station of Riom, or in about 3 hours from that of Saint-Eloy.

Amongst other French simple alkaline waters the following may be mentioned: **ANDABRE**, in Dep. Aveyron (see under **SYLVANÈS**); **ARTONNE**, in Dep. Puy-de-Dôme (a gaseous water containing, according to Parmentier, 2.4 per mille bicarbonate of sodium and 0.9 per mille bicarbonate of calcium); **DÉSAINES**, in Dep. Ardèche (3 to 4.1 per mille bicarbonate of sodium); **MARCOLS**, in the same Department (2.4 to 2.6 per mille bicarbonate of sodium); and **MONTROND**, in Dep. Loire, with the Source Geyser (containing 4.5 per mille bicarbonate of sodium). **POUGUES-LES-EAUX** has been classified in the earthy group (see Chapter XXVI).

San Marco, in Tuscany, 3 miles from Castiglione-della-Pescaja, has a gaseous alkaline water, which is exported with or without additional carbonic acid gas. According to A. Nannini Tanucci, 1884, it contains 1.3 per mille bicarbonate of sodium, 1.6 per mille bicarbonate of magnesium, and 0.26 per mille bicarbonate of lithium (total solids, 5.3 per mille).

Bagno-in-Romagna (Province of Florence) is pleasantly situated in a valley of the Apennines (1,640 feet above sea-level) to the east of Florence, and about 6 hours distant by carriage from the railway station of Forli. The thermal alkaline water (about 105° F.) contains 6.6 per mille sodium carbonate, and 1 per mille of common salt, and has a smell of sulphuretted hydrogen. It is, however, most conveniently classified amongst simple alkaline waters.

San Hilario (Spain, Province of Gerona) lies in the mountains at an altitude of rather over 2,000 feet, and possesses cold gaseous alkaline waters, containing about 1 per mille of mixed bicarbonates of sodium and calcium.

Mondariz (Spain, Province of Pontevedra) possesses cold gaseous alkaline waters, used for dyspeptic and gouty conditions, glycosuria, &c.

Marmolejo (Spain, Province of Jaen) possesses gaseous weak alkaline waters (70° F.), containing about 1.4 per mille sodium bicarbonate, and employed in chronic disorders of the digestive organs.

Vidago, in the north of Portugal, has alkaline waters used in similar cases to those in which the Vichy waters are employed. According to the analysis of Professor Lourenço, the Vidago spring contains 4·6 per mille bicarbonate of sodium, 0·9 calcium bicarbonate, 0·03 lithium bicarbonate, and 0·01 bicarbonate of iron, together with a fair amount of free carbonic acid gas. The taste is not at all unpleasant, and the water is exported in bottles. The other springs at Vidago are less highly mineralised. The season is from the beginning of June to the end of September.

Borjom (Russia, Tiflis), not far from Abbas-Tuman in the Caucasus, has, on account of its simple alkaline waters, obtained the name of the 'Russian Vichy.' According to the analysis given by Dr. F. G. Clemow, the Catherine spring (total solids 6·3 per mille) contains 5·0 per mille bicarbonate of sodium and 0·01 bicarbonate of iron ; its temperature is 84° F.

CHAPTER XX

MURIATED (CHLORIDE-CONTAINING) ALKALINE WATERS

THESE waters are employed in the same class of cases as the simple alkaline waters, especially when loss of flesh is to be avoided. According to A. Bickel's noteworthy experiments, which have been already shortly described at the commencement of Chapter XVIII, muriated alkaline waters (Ems) certainly do not lower the specific secretory activity of the gastric mucous membrane, and are to be preferred to simple alkaline and sulphated alkaline waters in all cases of organic gastric disorder (for instance, chronic catarrhal cases) when associated with diminished secretion and subacidity of the gastric juice.

This class of waters is not so likely to produce the depressing effects which the simple alkaline waters occasionally do. It may be mentioned also that common salt by itself is said by some to be of therapeutic use in the tendency to formation of uric acid calculi and gravel, owing perhaps to an inhibitory action on the deposition of uric acid (cf. J. Felix's experiments with Châtel-Guyon water, p. 400). The common salt probably lessens the tendency of the sodium bicarbonate to render the urine too alkaline, and makes up for the increased amount of sodium chloride excreted in the urine when the alkaline salt is being taken.

In some cases the use of the bicarbonate by itself, either in the form of an ordinary medicine or in mineral waters, may produce an attack of acute gout, whereas when given together with common salt it is less likely to do so. Sir W. Roberts,¹ however, holds that in cases of real gout all unnecessary ingestion of sodium salts should be avoided, because these salts favour the precipitation of biurates of sodium in the body, and may thus increase the gouty troubles, and produce exacerbations of articular gout. Pathological knowledge as to the precise chemical processes which occur in the human body in gouty conditions is still deficient, and according to some theories² muriated alkaline waters ought to be of great service.

¹ *Croonian Lectures on the Chemistry and Therapeutics of Uric Acid Gravel and Gout*, London, 1892; also Article in Allbutt's *System of Medicine*, vol. iii. 1897.

² See Mordhorst, *Lancet*, July 17, 1897.

The muriated alkaline waters are useful in cases of chronic catarrh of the respiratory organs (see Chapter XIV), and in these cases the climate of the spa is of great importance. It is supposed that the internal use of the waters helps to make the bronchial secretion less viscid and thus facilitates expectoration.

In anæmic and cachectic cases the iron (e.g. at Royat, &c.) and arsenic (e.g. La Bourboule, Royat, &c.) may partly explain the action of some of these waters.

In describing the spas belonging to this group Ems and Royat will be placed as types first, and the rest in political geographical order will be arranged to follow them.

Ems, Germany (Prussia, formerly Duchy of Nassau).—Ems (altitude 260 feet) is beautifully situated in the narrow valley of the Lahn on both sides of the river, and is sheltered from north and east winds. It consists of a mass of hotels, villas, bath-houses, with a magnificent Kursaal, &c.; these show to what an extent the place is made use of as a health resort and for pleasure. The mild climate (too hot for many in the middle of summer) contributes doubtless to the use of this spa in laryngeal and bronchial catarrhs.

There are in use several different thermal muriated alkaline springs, of temperatures varying from 80° to 120° F., but for our present purpose, owing to their remarkable uniformity in solid constituents, we can really speak of an 'Ems water' just as we do of a 'Carlsbad water,' without signifying the special spring. The Ems water contains, according to R. Fresenius, about 2 per mille bicarbonate of sodium, with 1 per mille common salt (total solids, about 3·5 per mille), and over 500 volumes per mille carbonic acid gas. Of the muriated alkaline springs used for drinking, the Kesselbrunnen (about 115° F.) is the hottest, whilst the Kaiserbrunnen (83·3° F.) and the Victoriaquelle (82·2° F.) are the coolest and richest in carbonic acid gas. The well-known Kränchen has a temperature of 96·5° F. There is likewise a chalybeate spring (temperature 70° F.) containing 0·02 per mille carbonate of iron.

The baths are nicely fitted up, and furnished with apparatus for hot and cold douches; massage may be had in suitable cases. Besides the baths there are rooms for gargling, for nasal douches, and for inhaling the finely pulverised water, simple or medicated with Peruvian balsam, oil of pine, menthol, &c. Various forms of inhalation apparatus &c. are employed in the treatment of patients with chronic catarrhal conditions of the nose, pharynx, larynx, and bronchi. Bronchitis in gouty persons is especially treated at Ems. In cases of pulmonary emphysema an apparatus is frequently used for expiration into rarefied air and in-

spiration from air of increased density, after the method of Waldenburg. Dr. Nicola Geissé considered the employment of such an apparatus to afford a capital pulmonary exercise when used methodically once or twice a day for fifteen minutes. There are likewise compressed air chambers, but they are less in demand at Ems than at Reichenhall.

The waters of Ems are also used in catarrhal and gouty dyspepsia with hyperacidity, in cystitis, and in various gouty conditions, especially in thin or weak persons, where the simple alkaline waters, as of Vichy and Neuenahr, and the sulphated alkaline waters, as of Marienbad and Karlsbad, are considered too lowering. Good results are claimed in some cases of chronic albuminuria.

The baths are employed in cases of leucorrhœa, catarrhal conditions of the uterus and cervix uteri, and in nervous cases of dysmenorrhœa. In some cases a vaginal douche is employed whilst the patient is in the bath. Ems has an old reputation in cases of sterility, as the name of one of its springs, the 'Bubenquelle' (95° F.), calls to mind.

During hot weather the shady walks on the hillsides are very agreeable for those who are able to take them. A funicular railway has recently been constructed up the Malberg on the south of the town, and patients may thus quickly reach the refreshing air of the woods on the summit, which is about 1,090 feet above sea-level.

Royat, France (Department of Puy-de-Dôme).—Royat is situated in the Auvergne Mountains on the lower slopes of the Puy-de-Dôme, at an altitude of 1,480 feet. Its position at the entrance of the Tiretaine Valley is most beautiful. The hotels and villas which constitute the spa stand chiefly on the right side of the stream; towards the east they overlook the city of Clermont-Ferrand (about 1½ miles distant), and the broad fertile plain of the Limagne, watered by the Allier River, on the opposite side of which are the outlines of the Forez hills; towards the west the old town of Royat stretches up the valley in the direction of the summit of the Puy-de-Dôme. The lesser heights towards the north and north-west afford protection against excessive winds.

On account of its thermal muriated alkaline springs Royat has been called the French Ems, but the Royat waters are likewise decidedly ferruginous, containing 0.02 to 0.056 per mille of the bicarbonate of iron.

The four springs are the Grande Source or Source Eugénie, the Source César, the Source Saint-Mart, and the Source Saint-Victor. The temperatures are 68° F. to 95° F. The Source Eugénie, which

is the warmest and most highly mineralised (the total of solids is 5·6 per mille), contains 1·7 per mille common salt, 1·3 per mille bicarbonate of sodium, 1·9 per mille bicarbonate of calcium, 0·04 per mille bicarbonate of iron, 0·035 chloride of lithium, and a trace of arsenic. Of the other three springs the Saint-Victor has the lowest temperature and contains the most iron (0·056 per mille of the bicarbonate) with 0·004 per mille of the arseniate of sodium; the Saint-Mart has the greatest amount of carbonic acid gas; and the César is the least mineralised (2·8 per mille).¹ There are likewise bituminous waters, but these are not made use of at present.

The chief bath-house of Royat is well arranged; the small one (César) has very limited accommodation. Close by the modern establishment are extensive remains of the Roman thermæ, excavated in 1882.

The Royat waters are employed for drinking, for baths, swimming baths and douches, for sprays and inhalation. The carbonic acid so plentifully supplied by the springs is sometimes used in the form of gas baths (Chapter XIV), more often for local douches, especially to the vagina. Gaseous (effervescent) baths at the constant temperatures of the springs can be given either with the Eugénie water or the César water, the latter of which, though of lower temperature, contains more carbonic acid gas than the former. By means of a special arrangement an ordinary mineral water bath can be supercharged with carbonic acid gas, the gas being introduced from the carbonic acid reservoir by numerous perforations in a pipe coiled round the bottom of the bath. A high degree of effervescence is thus produced, probably as much as in any Nauheim bath or in any gaseous 'iron bath.'

The affections treated at this spa include rheumatoid arthritis, gout and the uric acid diathesis, atonic dyspepsia, chronic laryngitis, and bronchitis. Chronic skin eruptions (eczema, psoriasis, urticaria) and gynæcological affections may be benefited, especially when occurring in arthritic subjects. The main indications are anæmia and arthritism. Neurotic troubles associated with anæmia or arthritism are often likely to be improved. When anæmia forms an indication, the Source Saint-Victor, on account of the iron and arsenic it contains, is generally preferred, whereas the Source Saint-Mart (0·035 per mille chloride of lithium) has a special reputation in gouty cases. The Source César, owing to its comparatively weak mineralisation, is the least likely to disturb the digestion. Inhalation treatment is adopted for diseases of the

¹ A. Duboin (*Comptes Rendus de l'Académie des Sciences*, Paris, 1899, vol. cxxviii. p. 1469) appears to have proved the presence in the Royat waters of minute quantities of iodine in organic combination.

respiratory system. Douches and massage are much employed when the joints are affected. The effervescent baths already referred to are useful in many cases when there is cardiac weakness.

Saint-Mart is occasionally used as a dietetic drink, and courses of this water are often taken away from the spa. Saint-Victor and César are likewise exported.

The season lasts from May 15 to September 15. There are many beautiful walks and interesting excursions to be made in the neighbourhood. Royat is connected with Clermont-Ferrand by electric tramway, train, and omnibus.

The waters are drunk in the morning about 7 or 8 o'clock, and often again in the afternoon about 4 o'clock. Sometimes a syrup is added to the water. The baths, douches &c. can be taken in the morning or afternoon. The general French method is to get through the morning bathing and drinking on an empty stomach and take *déjeuner* at 10.30 or 11 A.M. Many of the English, however, are recommended to take coffee at about 9 o'clock, that is at a convenient time after drinking the waters, and to have their bath later on in the morning, delaying their midday meal or lunch till 1 o'clock.

Toennistein (Rhenish Prussia), in the Brohl Valley, at an elevation of 420 feet, is an hour's distance from the railway station of Brohl. In the neighbourhood is the 'Heilbrunnen,' a gaseous muriated alkaline spring containing about 2.5 per mille bicarbonate of sodium, 1.6 bicarbonate of magnesium, 1.4 common salt, 0.02 bicarbonate of iron, and 1,270 per mille volumes of carbonic acid gas. There are likewise two gaseous alkaline chalybeate springs, the *Stahlquelle* (Natronlithionquelle) and the *Angelikaquelle* (total solids 2.5 to 3 per mille).

Offenbach, on the Main, 4 miles from Frankfurt, has a muriated alkaline water, the *Kaiser-Friedrich-Quelle* (total solids 4.2 per mille), containing about 2.4 per mille bicarbonate of sodium, 1.2 common salt, 0.4 sodium sulphate, and 0.019 bicarbonate of lithium. The water, which is naturally poor in free carbonic acid gas, can be obtained artificially aerated if desired.

Assmannshausen (260 feet), Prussia (Province of Hesse-Nassau), beautifully situated on the right bank of the Rhine at the foot of the *Niederwald*, possesses a tepid weakly mineralised muriated alkaline spring (temperature 82.8° F.). The bicarbonate of lithium (0.028 per mille out of a total mineralisation of only 1 per mille) in the water has been supposed to exert an especial therapeutic effect in gouty cases.

Weilbach, in the Prussian province of Hesse-Nassau. The 'Natronlithionquelle' belongs to the muriated alkaline group,

but is noticed with the other Weilbach springs in Chapter XXV amongst the sulphur waters.

Wildungen, in Germany (Principality of Waldeck). This spa is described in the earthy group (Chapter XXVI), but the Helenenquelle and the Königsquelle may likewise be mentioned amongst muriated alkaline waters.

Gleichenberg (Styria), 980 feet above the sea, lies in a pleasant, hilly, and well-wooded country, one and a quarter hours' drive from the railway station of Feldbach, and three hours' from Graz. The place is resorted to for its mild climate and its cold gaseous muriated alkaline waters, especially in cases of chronic (including tuberculous) affections of the respiratory organs and dyspeptic conditions. The chief springs are the Constantin-Quelle (3·6 per mille bicarbonate of sodium, 1·8 common salt, 1,340 per mille volumes of carbonic acid gas), and the less gaseous Emma-Quelle. In the neighbourhood is the gaseous weak chalybeate Klausen-Quelle, sometimes used for anæmic patients and at the end of the treatment. The alkaline chalybeate Johannis-Brunnen, situated at a distance of about one hour and a half, is used on account of its agreeable refreshing taste.¹ Inhalations of the pulverised water and hydrotherapeutic procedures are frequently resorted to as aids in the treatment at Gleichenberg, which enjoys a great reputation throughout the Austro-Hungarian Empire and in South Germany.

Sanct Lorenz, a station on the Rudolfsbahn, in Upper Styria, possesses two gaseous muriated alkaline springs, used for exportation. The Sanct Lorenzquelle, according to R. Goddeffroy's analysis, contains 1 per mille carbonate of sodium, 0·5 per mille carbonate of calcium, 0·07 per mille carbonate of iron, 2·7 per mille common salt, and 0·06 chloride of aluminium. The Fentscherquelle, called 'Austrian Selters' water, is slightly less mineralised (total solids amount to 4 per mille), and contains only 0·03 per mille bicarbonate of iron. Both of these springs, but especially the former, deserve a place likewise in the chalybeate group; the latter could be used as a dietetic drink in many cases.

Luhatschowitz, in Moravia, a quarter of an hour's distance from the village of that name, and one and a half hours' drive from the railway station of Ungarisch-Brod, lies in a pleasant valley of the Carpathians, 1,600 feet above sea-level. It possesses cold gaseous muriated alkaline waters, containing iodine and bromine, and is chiefly used for drinking. According to J. Picek (1891), the Vincenz-Quelle and the three other chief springs contain 3·0 to 4·4 per mille carbonate of sodium, 2·4 to 4·5 per

¹ According to Szaboky (*Wiener klin. Wochenschrift*, 1906, No. 6, p. 151) the maximum depression of the freezing point for these four springs is respectively 0·517°, 0·432°, 0·090°, and 0·387° C.

mille common salt, 0·007 to 0·012 per mille iodide of sodium, 0·02 to 0·045 bromide of sodium, 0·37 to 0·52 borate of sodium, and much carbonic acid gas. The waters are exported, and can be well used at home. They exercise a checking influence on the tendency to uric acid gravel (cf. p. 400, Felix's experiments in regard to the inhibitory influence of Châtel-Guyon water on the deposition of uric acid), and are also useful in catarrhal conditions on a gouty basis. Two or three tumblerfuls can be taken in the 24 hours, but the amount required varies in different cases. The admixture of common salt in these waters lessens the tendency of the sodium bicarbonate to render the urine too alkaline, and to exercise a depressing effect on the constitution. There are many persons in whom the use of sodium bicarbonate by itself has this depressing influence; whilst in the same persons the combination of common salt and sodium bicarbonate is much better borne. The season is from May 15 to the end of September.

Szczawnica, in Galicia, is situated on the northern declivity of the Carpathians, at an elevation of 1,700 feet above sea-level. It possesses cold muriated alkaline springs rich in carbonic acid gas; of these the Magdalenen-Quelle contains 8·4 per mille bicarbonate of sodium and 4·6 per mille chloride of sodium. Chronic catarrhal affections of the respiratory organs are suitable for this spa, which possesses also means for inhalation treatment, and for whey and koumis 'cures.' It is a six hours' drive from Alt-Sandeck, the nearest railway station. The season is from the end of May to the end of September. Mean temperature for the three summer months, 60·4° F.

Czigelka, in Hungary (Comitat Saros), possesses gaseous muriated alkaline waters. The exported water of the Ludwigsquelle contains about 4·6 per mille common salt, 8 per mille bicarbonate of sodium, and 0·015 iodide of sodium.

Kovaszna and Vajnafalva, neighbouring villages in Transylvania (altitude 2,800 feet), possess cold gaseous muriated alkaline waters and a natural supply of carbonic acid for gas baths.

Lipik, in Slavonia, not far from the railway station of Pakracz, has a sheltered position in a valley, at an elevation of 500 feet. The hottest of its weak muriated alkaline waters (temperature 147° F.) contains 1·9 per mille bicarbonate of sodium, 0·6 common salt, 0·014 iodide of sodium, and a moderate amount of free carbonic acid gas. The waters are used both internally and externally.

Châtel-Guyon (France, Department of Puy-de-Dôme) lies in a pleasant part of the Auvergne, at an altitude of 1,300 feet. The spa is situated to the west of the old town, at the entrance of the valley of the Sardon stream, and is fairly well sheltered

from the north-west wind. There are two bath establishments and arrangements for hydrotherapeutic treatment.

Its alkaline earthy muriated waters, rich in carbonic acid gas (temperatures 75° to 98·6° F.), contain a considerable quantity of iron, and, owing to the presence of chloride of magnesium, exert a slightly laxative action. Following are the chief chemical constituents of the 'Source Gubler' (temperature 89·6°) according to the analysis made in 1878 by Dr. Magnier de la Source: Bicarbonate of calcium, 2·1 per mille; bicarbonate of sodium, 0·95; bicarbonate of iron, 0·06; bicarbonate of lithium, 0·019; chloride of magnesium, 1·5; chloride of sodium, 1·6. The Source Gubler is very rich in carbonic acid gas and is the only one of the springs used for exportation. In its chemical constitution it may be regarded as the type of the Châtel-Guyon springs.¹

Owing to the combination of the chlorides with the iron in the waters and their laxative character, the spa has been sometimes called the French Kissingen, but the springs are more correctly classed amongst the muriated alkaline than amongst the muriated group. The class of cases treated at Châtel-Guyon includes atonic dyspeptic and chronic catarrhal conditions of the digestive organs, especially those associated with 'abdominal plethora' and chronic constipation. According to A. Baraduc, in cases of chronic constipation the laxative effect is often not evident at once; in such cases it frequently shows itself after the course of waters is over, but lasts longer than the same effect does when brought about by a stronger saline purgative treatment. Dr. Baraduc recommends Châtel-Guyon in that obstinate chronic affection known as muco-membranous colitis or enteritis, or 'entérite mucomembraneuse.' (On the suitability of Plombières, Châtel-Guyon, Homburg, Kissingen &c. in various types of muco-membranous colitis, see Chapter XXXVI.) The season lasts from May 15 to October 15. The distance from the railway station of Riom is about 3½ miles (50 minutes by omnibus).

Saint-Nectaire, in France (Department of Puy-de-Dôme), lies in a beautiful valley of the Auvergne Mountains, at an altitude of 2,500 feet. There are numerous muriated alkaline springs, with temperatures ranging from 50° to 111° F., and all of them containing iron (about 0·01 to 0·025 per mille of the bicarbonate), lithium (up to 0·095 of the bicarbonate), and small quantities of arseniates (up to 0·005 arseniate of sodium).

The 'Source du Mont-Cornadore' contains 2 per mille of both the chloride and the bicarbonate of sodium (temperature

¹ Total solids in the Source Gubler 7·4 per mille; depression of the freezing point 0·398° C. Total solids in the Kissingen Rakoczy spring 8·5 per mille; depression of the freezing point 0·47° C.

105·8° F.). The cold 'Source Rouge,' so named from its ochreous deposit, contains about 0·02 per mille bicarbonate of iron, 0·069 per mille bicarbonate of lithium, 2·3 per mille common salt, 2·7 per mille bicarbonate of sodium, traces of arseniates, and a considerable amount of free carbonic acid gas. The cold 'Source des Dames' contains about 2·5 per mille each of common salt and bicarbonate of sodium, 0·016 per mille bicarbonate of iron, and arsenic equivalent to 0·005 per mille of the arseniate of sodium. The 'Source Boëtte' is the hottest of the springs (111° F.).

The waters are employed for drinking, for baths, swimming baths, and douches. The carbonic acid gas obtained from the water may be employed for 'gas douches' (Chapter XIV). A small intermittent spring at Saint Nectaire-le-Haut, very rich in carbonic acid gas, is sometimes used as a vaginal douche, to combine the effect of the carbonic acid gas douche and the ordinary mineral water douche.

The Saint-Nectaire waters are employed in chronic rheumatic affections and 'neuralgias,' especially in the form of hot douches; in atonic dyspepsia; and in torpid types of anæmic, scrofulous, and chronic gynæcological affections. The waters have likewise been recommended by Ducrohêt in certain forms of albuminuria, especially in those of a gouty nature, and those designated 'phosphaturic albuminuria' by Robin, when as yet the fault lies rather in the general metabolism of the body than in any organic disease of the kidneys. Robin¹ has advised their use as part of the treatment in what he terms 'dyspeptic albuminuria.' The precise pathogeny of these forms of albuminuria is, however, still uncertain.

The Bath-establishment of Mont-Cornadore, in Saint Nectaire-le-Haut, is about three-quarters of a mile from the two establishments and the Casino of Saint Nectaire-le-Bas. The season is from June to the commencement of October. There are pleasant and interesting excursions to be made in the neighbourhood. Saint-Nectaire is 2 hours by omnibus from Coudes, a railway station on the line between Clermont-Ferrand and Issoire.

Vic-le-Comte (France, Puy-de-Dôme), on the Allier, possesses several muriated alkaline springs in its neighbourhood, resembling in their chemical constituents the Royat waters. The most important is the Source Sainte-Marguerite (temperature 88° F.) at SAINT-MAURICE, which contains about 2 per mille both of the bicarbonate and the chloride of sodium, about 0·05 per mille bicarbonate of iron, and 0·002 per mille arseniate of sodium. The railway station is 3 miles distant.

La Bourboule (France), in the Auvergne Mountains. The waters have been classed in the arsenical group (see Chapter XXIV).

¹ *Bulletin de l'Acad. de Méd.* August 17, 1897.

Rouzat (France, Puy-de-Dôme) lies at an altitude of about 1,300 feet, $4\frac{1}{2}$ miles from Riom. It possesses muriated alkaline earthy springs, of which the 'Source Grand Puits' (88° F.) was known to the Romans.

Vic-sur-Cère (France, Cantal).—The waters will be referred to in the arsenical group (Chapter XXIV).

Pozzuoli (Italy), the ancient Puteoli, on the Bay between Naples and Baja (Baia), possesses thermal weak muriated alkaline waters known to the ancients and still employed. The 'SOLFATARA,' the crater of a half-extinct volcano near Pozzuoli, has 'fumeroles' yielding sulphurous fumes, which were used for medical purposes in Roman times. On the hills above the Solfatara are the Pisciarelli springs (Fontes Leucogæi of Pliny), mentioned in Chapter XXIII. Not far from Pozzuoli are the hot springs of BAGNOLI (the 'Balneolum' of Pliny), and the natural vapour baths or 'stufe,' called the BAGNI DI NERONE. The sulphurous STUFE DI SAN GERMANO,¹ close to the well-known 'Grotta del Cane,' are on the south bank of the so-called LAGO D' AGNANO, an extinct crater, formerly a lake, but drained in 1870.

Telese, a station on the railway between Naples and Rome, two hours distant from Naples, possesses sulphurous waters, with a thermal establishment and hotel accommodation.

Ischia.—This beautiful island of the Bay of Naples possesses several thermal springs² known from ancient times. The best known is the weak muriated alkaline source of 'Gurgitello' near CASAMICCIOLA, the temperature of which varies between 131° and 149° F. According to Palmeri and Coppola (1879), the Gurgitello water (sold also in Naples) contains 2·7 per mille common salt, and 1·5 per mille bicarbonate of sodium (total solids 5·8 per mille). The most satisfactory accommodation in the island is to be had at Casamicciola; but there are likewise hotels at PORTO D' ISCHIA (or Bagno d' Ischia), $3\frac{1}{2}$ miles distant. At the latter place there is a military thermal establishment (Casina reale), founded in 1875, as well as the municipal establishment inaugurated in 1881. Natural vapour baths ('stufe') exist at CASTIGLIONE and elsewhere in the island. Sand baths and sea baths can be taken on the shore. The island and bathing arrangements suffered terribly from the earthquake of 1883.

Castellammare-di-Stabia, in Italy (the Roman Fontes

¹ The stufe of San Germano contain a little sulphuretted hydrogen like the natural vapour baths of Le Montet at Cransac, in France (mentioned in Chapter XXVI), and the sulphurous cavern of the 'Stinkberg' of Torja, near Tusnad, in Transylvania (mentioned in Chapter XXIII). The latter cavern, however, also contains a layer of carbonic acid gas, like the famous Italian 'Grotta del Cane,' which, as we have stated, is situated close to the stufe of San Germano.

² In one or more of these springs considerable radio-activity has lately been detected.

Stabiæ), through its beautiful situation on the south coast of the Bay of Naples, is one of the most delightful marine resorts of Italy. It also possesses cold alkaline earthy muriated waters (employed from ancient times) and balneotherapeutic arrangements. The 'Acqua del Muraglione' is said to contain about 5 per mille common salt and 1 per mille bicarbonate of calcium. Some of the springs contain iron, and two are termed sulphurous. Evidence of considerable radio-activity has recently been detected in the weakly mineralised and slightly gaseous 'acqua acidula' spring. As a mineral water and sea-bathing summer resort the place is chiefly frequented by Italians; as a climatic resort for spring, winter, and autumn by visitors from Northern Europe.

Los Hervideros-de-Fuen-Santa (Spain, Province of Ciudad Real), in the plain of Calatrava (altitude 2,130 feet), possesses gaseous muriated alkaline waters (71° F.), containing bicarbonate of iron and some arsenic, like those of Royat in France. The waters of VILLAR-DEL-POZO, in the same neighbourhood, are more weakly mineralised.

Essentuki (Russia), in the Caucasus, is situated about 10 miles to the west of Piatigorsk (*q.v.*), and is said to have about the same altitude and climate. It possesses cold muriated alkaline springs. Others of its springs are sulphurous and only used externally. The best known of its muriated alkaline waters is the Spring No. 17, which, according to Dr. F. G. Clemow, has been called the 'Pearl of the Caucasus,' and, according to Thomin (1888), contains 4·3 per mille carbonate of sodium and 3·6 per mille common salt, with minute amounts of barium, strontium, and lithium salts. Dried salts and tabloids of the salts are prepared from the spring. According to N. N. Sokoloff's¹ experiments the drinking of Spring No. 17 (a bottle a day, either aerated or in its natural condition) appears to increase the excretion of both uric acid and urea, but that of the former more than of the latter.

¹ Note on his St. Petersburg medical thesis in the *Gazette des Eaux*, Paris, August 3, 1899.

CHAPTER XXI

SULPHATED ALKALINE WATERS

THESE waters are useful in constipation, associated with 'abdominal plethora,' also in cases of hæmorrhoids and disturbance of the female pelvic organs, especially when these disorders occur in large eaters and corpulent persons, in whom loss of flesh is to be desired rather than feared.

They may be serviceable also in gastric and intestinal catarrhs in stout and full-blooded individuals, especially in those who have indulged much in the luxuries of the table, in cases of catarrhal jaundice, in tendency to the formation of gall stones, in congestion of the liver, in enlargement of this organ or the spleen,¹ resulting from malarial affections, and in many unhealthy conditions resulting from malaria, improper diet and regimen, or prolonged residence in hot countries. They are likewise useful in uric acid gravel, and in some cases of gout and glycosuria in fat persons.

Other waters are usually preferable in thin and feeble individuals. Although A. Bickel's experiments, alluded to in Chapter XVIII, showed that sulphated alkaline waters (Karlsbad) do not lower the specific secretory activity of the stomach as decidedly as might be expected (possibly because they contain carbonic acid gas and common salt in addition to the sulphate and bicarbonate of sodium), these waters should be employed in organic gastric disorders associated with excessive hydrochloric acidity and excessive secretion rather than in those associated with subacidity. It is possible, however, that small doses of sodium sulphate may increase the motor action of the muscular walls of the stomach in atonic cases.

In the results obtained by the sulphated alkaline waters diet plays a most important part, especially so in cases of glycosuria and obesity. By diet is of course meant the diet suitable to the individual patient, not any special 'Curgemäss' diet, such as was formerly employed at some spas more or less uniformly in the

¹ See further on.

case of all patients, no matter what were the differences in their complaints. The amount of fat has certainly to be limited in some cases, and naturally in persons who take the mineral waters on account of obesity. F. Kraus¹ has, however, shown for the sulphated alkaline waters, such as Karlsbad, just as C. Dapper² proved for the muriated waters, such as Kissingen and Homburg, that the proper utilisation of suitable forms of fat in the diet is by no means prevented by the simultaneous employment of the mineral waters in question. Kraus gave considerable amounts of fatty food to hospital patients in C. von Noorden's clinic at Frankfurt, taking care to select only patients who suffered from complaints likely to be met with at Karlsbad; these he treated at the same time with fair daily doses of Karlsbad water. He found that the percentage of the ingested fat, which could be recovered from the patient's fæces, was not unduly increased by the use of the mineral water. Sometimes the mineral water seemed to make hardly any difference in this respect.

It is claimed that chronic enlargement of the spleen occurring as a result of malaria may be diminished by courses of the alkaline sulphated waters; the amount of benefit actually obtained varies much in different cases.

The spas of this group will be described in the following order: Karlsbad, Marienbad, Franzensbad, Tarasp-Schuls, Elster, &c. In choosing between the spas of this group their climates, the time of year, the local medical guidance and, to some extent, the inclinations of the patient have to be considered, as well as the temperature and mineralisation of their springs and their balneotherapeutic resources, including 'accessory spa-treatment.'

Karlsbad (Carlsbad), in Bohemia.—Karlsbad (altitude about 1,230 feet) is a long narrow town stretching upwards in the narrow valley of the Tepl, on both sides of the stream, from its entrance into the Eger for about two miles in a southward direction. Owing to the somewhat cramped position of the houses of the main streets of this ever-increasing spa, many of the guests prefer to live in the buildings situated higher up on the Schlossberg, &c., where the air is fresher and purer; in fact, the new hotels and lodging-houses are built on the slopes above the valley and not in the 'Alte Wiese' and the 'Neue Wiese,' close to the banks of the stream. It should, however, be mentioned that much has been done, and is still being done, to broaden the main thoroughfares and open out the older portion of the spa. Beautiful walks

¹ *Berliner klin. Wochenschr.* 1897, No. 21.

² *Zeitschr. für klin. Medicin*, 1896, vol. xxx., and Noorden's *Sammlung klinischer Abhandlungen*, Berlin, 1904, No. 5.

can be enjoyed in the woods covering the slopes of the valley, and a favourite walk which needs no climbing is the one in the valley higher up along the Tepl. In one or other of the cafés along this road guests frequently breakfast after drinking the water.

There are a great many mineral springs at Karlsbad, but they are remarkably similar in their solid constituents, so similar in fact that there is supposed to be some large natural reservoir in the rocks below the town from which the springs all derive their water. Hence one may really speak of a 'Karlsbad water,' which contains about 2·4 per mille sulphate of sodium, about 1·2 per mille bicarbonate of sodium, and 1 per mille common salt (total solids about 5·5 per mille), with a moderate amount of carbonic acid gas. It will be unnecessary here to mention all the sixteen springs of Karlsbad water; the chief difference between the various springs lies in their temperature, the hottest, moreover, having the least amount of carbonic acid gas.¹

The hottest of the springs is the famous Karlsbad Sprudel² (temperature 162·5° F.), a steaming fountain leaping up at short intervals in a jerky, irregular way; close by it, along the sides of the Tepl, clouds of steam arise from the ground itself. The Felsenquelle has a temperature of 138° F.; the Schloss-Brunnen of 127° F.; and the Mühlbrunnen of 124·5° F. The Spital-Brunnen in the Strangers' Hospital has the lowest temperature (95·4° F.) of the true Karlsbad waters, for the Stephaniequelle (temperature 71·9° F.), which arises below the Schweizerhof, at some distance from the other fountains, appears to be a spring of true Karlsbad water diluted and cooled during its passage to the surface by ordinary spring water. The Dorotheen-Säuerling, which arises close to the Stephaniequelle, is a simple acidulated spring, the water of which may be used as an ordinary refreshing draught or table water. The neighbouring Giesshübl and Kron-dorf table waters can be used at Karlsbad.

As a general rule, the hotter springs have a less laxative action than the cooler springs. If it is desirable to take the dose cold, the water may be obtained the evening before (the Sprudel, if very little carbonic acid gas be preferred), and allowed to cool at home during the night. Owing to the great number of guests, it is important that not all be told to drink from the same fountain.

During summer the usual time for drinking the waters is from half-past five to half-past eight in the morning, about a quarter of

¹ Decided radio-activity has been found present in Karlsbad springs (first detected in the gas arising from the waters—see A. Hermann and F. Pesendorfer, *Wiener klin. Woch.* 1904, No. 28, p. 792), and spring-deposits. For a comparison of the radio-activity of Karlsbad springs with some of those of Baden-Baden and the Black Forest see footnote under Baden-Baden in Chapter XVIII.

² The German term 'Sprudel' is applied to any gaseous spring which arises with sufficient force to leap up from the ground.

an hour being allowed after each glass (about six ounces). When, however, a comparatively large amount is taken, the daily dose may be divided into two or three portions, a second portion being taken in the forenoon, before the midday meal, and occasionally a third portion in the afternoon; this is also the case when the stomach can bear very little of the water at a time. Sometimes a dose is taken cold at bed-time. In former days enormous quantities of the water used to be taken, but now, as a general rule, the dose varies between two and six glasses (of about six ounces each), and in some cases, as for example when there is a tendency to chronic diarrhœa, the doctors begin with very small doses, such as half a glass (about three ounces), and even less.

Amongst the conditions for which the internal use of Karlsbad waters is useful, in the first place come affections of the liver, including catarrhal jaundice, chronic cholelithiasis¹ (on the indications in cases of cholelithiasis see Part III, Chapter XXXVI), early stages of hepatic cirrhosis, and enlargements of the liver in great eaters and from residence in tropical countries. Then come cases of habitual constipation and hæmorrhoidal conditions in robust persons; some cases of chronic gastric or intestinal catarrh in overfeeders, with or without diarrhœa; some cases of dyspepsia apparently without organic alteration in the alimentary tract; the uric acid diathesis; chronic glycosuria in fat people, and cases of obesity, which is often combined with a weakly acting heart. It is also maintained that the lesser degrees of chronic malarial enlargement of the spleen are benefited by a course of the waters. At all events many unhealthy conditions due to a disordered function of the digestive organs and abdominal viscera, resulting from chronic malaria or long residence in hot countries, are much improved by the Karlsbad treatment, whether there be actual enlargement of the liver and spleen or not.² Persons with periodic or

¹ In regard to the reputed cholagogue action of Karlsbad water many investigators have obtained negative results from experiments. See, however, Jacques Mayer's satisfactory explanation of the 'lithagogue' and general effects of Karlsbad treatment in cholelithiasis (*Verhandlungen d. XVII Congresses f. inn. Med.* 1899, p. 509).

² According to Sir Joseph Fayrer (*Indian Lancet*, February 16, 1898, p. 173), Karlsbad 'is to be especially recommended to those who, after protracted residence in India or other malarial climate, suffer from occasional recurrences of malarial fever, with consequent derangement of function and even alteration in the normal condition of liver, spleen, and other abdominal viscera; who, without suffering from any positive disease, are failing in health, have impaired digestion, distended condition of the abdomen, increasing fatty deposit in the omentum and a tendency to fatty degeneration of the muscular system generally, who find themselves languid and depressed, unequal to much physical or mental exertion, show indications of incipient anemia, suffer from dyspnœa, from rheumatic or gouty pains, irregular action of the bowels, congestion of the portal system, and distended hæmorrhoidal vessels—a state of things perhaps in some cases aggravated by excesses or irregularities of diet, or the neglect of due precautions as to the quantity or kind of alcoholic stimulants.'

frequently recurring headaches connected with abdominal disorders are likewise treated at Karlsbad, and often with great benefit. As a general rule very feeble patients are unsuitable subjects for Karlsbad treatment.

By no means all the patients who come to Karlsbad to drink the waters require a course of the mineral baths in addition. For cases, however, in which baths are indicated, Karlsbad is well provided; it contains six bath-houses, of which the 'Kaiserbad,' erected by the town, is the most complete, and is one of the most magnificent bath-houses in Europe. In addition to ordinary and mineral water baths there are arrangements for 'moor baths,' as at Franzensbad, the peat used for these baths being obtained from a tract of moor near Franzensbad. There are likewise arrangements for douches, hot air and vapour baths, massage, and for the use of Zander's medico-mechanical appliances.

In conducting the course of treatment, the spa doctor, of course, considers each case individually with regard to the nature of the affection, the constitution of the patient, and his previous habits. In a great number of cases, such as those of glycosuria, catarrh of the stomach and intestines, obesity &c. the regulation of the diet is of extreme importance. Formerly there was a special 'cure diet,' to which the patient was supposed to confine himself as a matter of course; thus all acid things were supposed to be antagonistic to the proper action of the Karlsbad waters; in no case was butter allowed; and 'Sprudelsuppe,' a soup made with Karlsbad water, formed the chief part of the evening meal. All this is now much modified: the resident doctors regulate the diet, according to ordinary indications to suit the individual patient, and with due regard to his previous habits. The absence of table d'hôte at the hotels assists the patients greatly in following the doctor's orders, though it must be admitted that the general provision of midday 'couverts' (i.e. dinners at fixed prices) must sometimes afford temptation to neglect precise instructions as to diet.

The average daily programme of ordinary 'Kurgäste' at Karlsbad may be shortly sketched somewhat as follows: Rising early to drink the waters at the fountain; in the interval between the glasses promenading to the sound of 'Kur-Musik;' then walking to some café, often to one of those beyond the town along the Marienbaderstrasse, and taking breakfast (at about 9 A.M.). This consists of coffee or tea, with rolls and perhaps boiled eggs or ham; a curious habit prevailing at Karlsbad is that the guests, after taking the waters, often buy their rolls direct from a baker, and carry them to the place where they breakfast. At about one o'clock the chief meal is taken, then coffee or tea at

about four, and a light supper in the evening. Those who have been ordered a course of baths mostly take them in the forenoon; promenades, listening to bands and concerts, or walks and excursions for those who are advised to take more active exercise, occupy the remaining intervals in the day. The old idea that *all* the invalids must take a large amount of walking exercise is now recognised as entirely erroneous.

The season lasts from the middle of April to the end of September, but guests are also received at other times of the year, though of course most of the hotels would then be shut. An 'after-cure' should always follow the course at Karlsbad (Chapter XXVIII).

Marienbad (Bohemia).—This much-frequented spa is beautifully situated (at an altitude of about 2,090 feet) in a rather open valley, and sheltered by an almost complete circle of hills, on which beautiful walks may be enjoyed amongst the pine forests.

The chief of the springs are the Kreuz-Brunnen and the Ferdinands-Brunnen, which are sulphated alkaline springs resembling those of Karlsbad, but are cold instead of hot, richer in the sulphate, bicarbonate, and chloride of sodium, and in carbonic acid gas, and containing respectively 0·048 and 0·084 per mille bicarbonate of iron. The Kreuz-Brunnen contains about 4·9 per mille sulphate of sodium, 1·6 per mille bicarbonate of sodium, and 1·7 per mille common salt, the sulphate of sodium being about double the amount in the Karlsbad springs. The Ferdinands-Brunnen resembles the Kreuz-Brunnen, but is richer in the above-mentioned saline constituents and in carbonic acid gas (5 per mille sulphate of sodium, 1·8 per mille bicarbonate of sodium, and 2 per mille common salt). The Alfredsquelle, slightly less mineralised than these two, contains about 3 per mille sodium sulphate, about 1·3 per mille sodium bicarbonate, and about 1 per mille common salt. The neighbouring Alexandrinenquelle, and the Waldquelle, at the opposite (north) end of the town, are more weakly mineralised, but distinguished for their relatively large amount of bicarbonate of sodium and carbonic acid gas. (The Waldquelle has 1·4 per mille bicarbonate of sodium to 1 per mille sulphate of sodium.) The Ambrosius-Brunnen and the Karolinen-Brunnen are chalybeate springs, the first being much the stronger, and being said to contain as much as 0·166 per mille bicarbonate of iron. The Rudolfsquelle is an alkaline earthy spring, which may be compared to the Helenenquelle at Wildungen. All the Marienbad springs are cold.

From the variety of springs it may be seen that different classes of cases can be treated at Marienbad. Patients with vesical catarrh and urinary complaints may be benefited, as at

Wildungen, &c., by drinking the water of the Rudolfsquelle, and observing the proper precautions as to diet. The Waldquelle is used as an aerated alkaline spring in chronic catarrh of the respiratory organs. Anæmic patients may drink the chalybeate waters of the Ambrosius-Brunnen, if it does not interfere with their digestion.

On the whole, however, the main class of patients coming to Marienbad are those likely to be benefited by a course of sulphated alkaline waters—namely, full-blooded and stout people who have led a sedentary life and fed largely; this class of patients, suffering from dyspepsia, the uric acid diathesis, chronic constipation, hæmorrhoids, or chronic catarrh of the large intestine, or affected with general obesity, possibly with enlargement of the liver and a weakly acting heart, may often be benefited by a course of waters at Marienbad. In such cases the Kreuz-Brunnen or Ferdinands-Brunnen are mostly employed. Furthermore, hepatic troubles, such as catarrhal jaundice, gall stones, and incipient cirrhosis, may be treated as at Karlsbad; so also chronic glycosuria in obese or fairly well-nourished persons. In the glycosuric and hepatic cases, as well as in many others, it is better to have the waters warmed, by which process they become very much like the waters of Karlsbad. In regard to cardiac affections Kisch¹ has drawn attention to the use of a course at Marienbad in some cases of fatty infiltration of the heart; in obese persons who are the subject of valvular disease, with perhaps commencing signs of disturbance in compensation; also in nervous disorders of the heart, associated with a gouty condition, habitual constipation, or in women with the onset of the climacteric period.

At Marienbad, as at Karlsbad, treatment by baths takes a secondary place, but there are four bath-houses, and all sorts of baths may be obtained. Another Marienbad spring, the Marienquelle, poor in solid constituents, but rich in carbonic acid gas, is used for mineral-water baths; the waters of the Ferdinands-Brunnen and the chalybeate Ambrosius and Karolinen springs are also used; the latter spring contains 1,514 per mille volumes of free carbonic acid gas. The indications for these baths are similar to those for the so-called 'iron baths' and other gaseous (effervescent) baths; in some cardiac cases they may replace the Thermal-Soolbäder of Nauheim (*q.v.*). 'Moor baths' (general and local) are given as at Franzensbad, and may be used in various chronic gynæcological affections, or in some cases merely as a variety of thermal bath. The ferruginous peat, used for Marienbad moor baths, is asserted to be very rich in iron like the Franzensbad peat. There are arrangements at Marienbad for douches, hot air and vapour baths, medico-mechanical treatment

¹ *Marienbad, als Curort für Herzkrankheiten*, 1897.

(a Zander institution), and likewise for carbonic acid gas baths, for which the gas arising from the Marienquelle is made use of. The wooded slopes around Marienbad, on which there are many restaurants, are admirably suited for graduated walking exercise.

The season lasts from May to September. The hotel accommodation is very good. An 'after-cure' is always advisable after a course of waters at Marienbad (see Chapter XXVIII).

Franzensbad, in Bohemia.—Franzensbad, near Eger, founded by the Emperor Francis II. in 1793, is situated in a flat part of the country at an elevation of about 1,500 feet above sea-level. The moorlands, whence is derived the peat used for the famous 'moor baths' of Franzensbad, immediately adjoin the town.

There are twelve different mineral springs, as well as a simple gaseous spring, which resembles ordinary effervescent 'table waters.' These twelve springs are all cold and rich in carbonic acid gas, but in their solid mineral constituents differ considerably. The Salzquelle, Franzensquelle, Wiesenquelle, and Kalte Sprudel, all used for drinking, are sulphated alkaline springs, whose waters contain 2·7 to 3·5 per mille sulphate of sodium, 0·67 to 1·1 per mille carbonate of sodium, traces of other carbonates, about 1·2 per mille common salt, with 0·009 to 0·030 per mille of the carbonate of iron. Of these springs the Salzquelle contains the least amount of iron (only 0·009 per mille of the carbonate), and is therefore the one which most resembles the waters of Karlsbad; this resemblance can be increased by warming its waters to the temperature of one of the Karlsbad springs. The Neuquelle, according to Prof. E. Ludwig's analysis ('Wiener klin. Wochenschrift,' 1893, No. 12), has a total of only 4·6 per mille solids, and is the richest of the Franzensbad springs in iron (0·12 per mille bicarbonate of iron, 2·6 sodium sulphate). The Stahlquelle contains about 0·079 per mille bicarbonate of iron, and less of the other salts (1·6 per mille sulphate of sodium, with a total solids of only 3·1 per mille), so that it may fairly be ranked as a strong chalybeate spring. The Stefaniequelle, the Herkulesquelle, and the Nataliequelle are gaseous mild chalybeate waters (total solids, just under two per mille), which can be used in some cases as 'table waters.'

Franzensbad possesses the 'Kaiserbad' and other well-provided bath houses, at which the three principal kinds of baths employed are the following: (1) The 'Stahlbäder.' This term is somewhat confusing. By it the mineral-water baths are meant, in which the warming process is so arranged (method of Schwarz) as to occasion the least possible escape of carbonic acid gas. The heating in these baths is effected by a steam chamber or steam pipes at the bottom of the bath. (2) The 'Luisenbäder' or 'Mineralbäder.' These are the ordinary mineral-water baths, in which steam is passed through the mineral water to heat it (method of Pfriem), necessitating the escape of the greater

amount of carbonic acid gas. Thus, by the loss of the gas, the 'Luisenbäder' are rendered less stimulating than the 'Stahlbäder.' (3) The 'Moorbäder,' for which Franzensbad has attained such a notoriety. The peat used for these baths is obtained from moorland in the immediate neighbourhood of the town, and the supply is so plentiful that the peat used for one bath need never be used a second time. According to Dr. Paul Cartellieri as much as 25 per cent. by weight of the disintegrated peat, when ready for use, consists of substances soluble in water, and 9.7 per cent.¹ is sulphate of iron. The usual temperature at which the 'moor baths' are given is 89.5° to 95° F.; they act as a huge poultice to the abdomen and lower limbs, and should not cover the upper part of the chest. Local peat baths, still more resembling poultices, are likewise given.

Besides the above-mentioned three chief kinds of baths, general and local baths of carbonic acid gas are likewise sometimes employed at Franzensbad. In the general gas bath the patient, clad in a light bathing dress, sits or stands in a sunken space, into the bottom of which a pipe leads, conveying carbonic acid collected from the mineral waters. An overflow pipe carries off the carbonic acid at a certain height, and thus avoids the danger of the patient inhaling it. A subjective sensation of warmth in the lower limbs and the part of the body bathed by the gas is produced, but the exact therapeutic value of these gas baths remains doubtful. According to Dr. L. Fellner,² the indications for the gas baths include peripheral nervous affections, anæsthesia, hyperæsthesia, neuralgia, and functional disorders of the sexual system; these baths are contra-indicated in tendency to hæmorrhage, and in chronic cardiac and pulmonary diseases.

At Franzensbad the daily dose of water is often divided into two portions, one to be taken before breakfast and one later on in the forenoon.

Owing to the differences between the various mineral springs at Franzensbad, different classes of cases can be treated at this spa. The sulphated alkaline Salzquelle can be used internally, warmed if necessary, in the same class of cases as the Karlsbad

¹ Ludwig, Hödlmoser, and Panzer with new elaborate analyses of the Franzensbad peat (*Wiener klinische Wochenschrift*, 1899, No. 17, p. 463) point out that the proportion of sulphate of iron in different specimens of peat must vary according to the duration of the preceding exposure, and accordingly as the specimen has been selected from the exterior or from the interior of the exposed mass; sulphate of iron, they think, is usually not present in the freshly dug peat, but is gradually formed afterwards from disulphide of iron (in which the fresh peat is rich) by chemical changes accompanying the process of disintegration. As to radio-activity in the peat used for the 'Moorbäder,' see the remarks in the footnote on the subject in Chapter XIII.

² 'Zur physiologischen Wirkung der Kohlensäurebäder,' *Berliner klin. Wochenschr.* 1905, No. 24.

waters; the sulphated alkaline Neuquelle, Franzensquelle &c. are useful, owing to their iron constituent, in anæmic conditions associated with constipation; whilst the purer chalybeate 'Stahlquelle' may be given in such anæmic cases as are benefited by ordinary chalybeate treatment.

Franzensbad has, however, obtained an especial reputation as a 'ladies' spa,' and by far the majority of the 'Kurgäste' belong to the female sex. They include girls and women suffering from chlorosis and other anæmic or cachectic conditions; cases of functional nervous troubles often associated with a debilitated condition of the whole body; dyspeptic troubles in which those Franzensbad waters most similar to the Karlsbad ones are likely to be useful; chronic rheumatic and gouty affections, when likely to be benefited by a judicious course of baths; lastly, there is the large class suffering from affections of the pelvic organs. Of the latter patients some are anæmic and likely to be benefited by drinking the iron waters, others are benefited by drinking from the more laxative springs; the 'Stahlbäder' or the 'Luisenbäder' exert a favourable effect in leucorrhœa and catarrhal conditions of the pelvic organs, and the 'Moorbäder' often help to promote the absorption of old pelvic exudations. The moor baths are likewise employed in various rheumatic, functional nervous, and cutaneous disorders. Broadly speaking, they are contra-indicated in diseases with a tendency to acute exacerbations, in diseases of the heart and blood-vessels, in tendency to hæmorrhage from various organs, and during pregnancy and generally during menstruation. The relatively recent employment of the gaseous iron baths (Stahlbäder) in the treatment of cardiac affections after Nauheim methods has enormously increased the annual number of patients visiting Franzensbad.

The season at Franzensbad lasts from May to the end of September. An 'after-cure' following treatment at Franzensbad is always to be desired (see Chapter XXVIII).

Tarasp-Schuls (Tarasp-Schuls-Vulpera), Switzerland (Graubünden).—The Kurhaus of Tarasp is situated in the Lower Engadine Valley, at an altitude of 3,890 feet, on the left (northern) bank of the Inn, that is on the opposite side of the river to the picturesque old castle of Tarasp, which cannot be seen from the establishment itself. The neighbouring villages of Schuls (altitude 3,970 feet) and Vulpera (altitude 4,180 feet) lie in a rather more open and sunny position and enjoy a more extensive view, but the peculiar secluded position of the Kurhaus and its proximity to the 'Trinkhalle' give it special attractions for some persons. The mineral waters have been known from the sixteenth century, and were highly praised in 1561 by the famous Zürich doctor, Conrad

Gessner, but it is only in comparatively recent times that they have been widely appreciated. Some of the springs yield sulphated alkaline water, known in the neighbourhood as 'Salzwasser;' others yield gaseous chalybeate water known as 'Sauerwasser.'

Amongst the sulphated alkaline springs, the Lucius and the Emerita, the two used for drinking, are the most important. According to Husemann (1872) they contain 2.1 per mille sulphate of sodium, which is about the same amount as that of the Karlsbad springs, but they are cold and much richer in bicarbonate of sodium, common salt, and carbonic acid gas than the Karlsbad water. The amount of sodium bicarbonate is 4.8 per mille, equalling that of Vichy; of common salt, 3.6 per mille; of bicarbonate of calcium, 2.4 per mille; and of bicarbonate of iron, 0.02 per mille. The Emerita spring differs from the Luciusquelle chiefly in being not quite so rich in free carbonic acid gas.¹

Amongst the chalybeate springs the 'Bonifacius' is the strongest, containing, according to Planta (1859), 0.045 per mille of the bicarbonate of iron, together with 1.4 per mille bicarbonate of sodium, 2.7 per mille bicarbonate of calcium, and much free carbonic acid gas. The Wyquelle, which arises above the village of Schuls, contains, according to Planta (1859), 0.03 per mille bicarbonate of iron and 1.7 per mille bicarbonate of calcium (total solids only 1.9 per mille) with about the same amount of free CO₂ as the 'Bonifacius' spring. The waters of both these springs can be obtained, when required, at the 'Trinkhalle' of the Lucius and Emerita springs, close to the Kurhaus. The gaseous weaker chalybeate 'Suotsasse' spring at Schuls (0.01 bicarbonate of iron and 1.4 bicarbonate of calcium) is much used at the spa as a pleasant table water. In the neighbourhood there are several other gaseous springs.

About three hours distant is the chalybeate spring of Val Sinestra (*q.v.*), rich in carbonic acid gas and containing arsenic. The Val Sinestra water can be now obtained at Schuls, freshly brought each day from the spring.

Besides the baths of gaseous water, which may be obtained at Schuls, as well as at Tarasp, there are arrangements for providing

¹ In 1899 the Lucius and Emerita springs were freshly enclosed, and as a result, their waters were found to contain much more free carbonic acid gas than before Treadwell's new analysis of 1900 was expressed according to the 'theory of ions,' but approximate equivalents in salts, given in Dr. A. Vogelsang's *Heilmittel und Indicationen von Tarasp-Schuls-Vulpera* (1901; p. 11), are: for the Lucius spring, sodium sulphate, 2.2 per mille; common salt, 3.8; sodium bicarbonate, 4.3; total solids, 12.8; and for the Emerita spring, sodium sulphate, 1.9; common salt, 3.2; sodium bicarbonate, 3.8; total solids, 11.3 per mille.

Rheinfelden brine baths, and Battaglia 'fango' baths at the Kurhaus of Tarasp.

The sulphated alkaline water is employed internally in chronic constipation, hæmorrhoids, dyspeptic conditions, and catarrh of the bowels when occurring in stout full-blooded persons, and in those who have been accustomed to live freely; in cases of gall-stones; in glycosuria of fat and gouty persons, &c. It may be made more to resemble the Karlsbad water by warming it before drinking; and this is especially important in cases of gall stones and allied affections. As much care is needed for the diet of individual cases at Tarasp as at Karlsbad.

The action of the chalybeate waters of Tarasp in anæmic and debilitated conditions is doubtless greatly aided by the Alpine climate. The arsenic contained in the water of Val Sinestra might exert a special influence in cases of malarial cachexia. The indications for the gaseous baths (warmed to the temperature required by coils of steam) of Tarasp and Schuls are similar to those of so-called 'iron baths' and baths of other gaseous (effervescent) waters.

The season lasts from June 15 to September 15. Regarding 'after-cures,' see Chapter XXVIII.

The neighbourhood of the spa is suitable for ordinary summer residence as well as for those undergoing a course of waters; the climate is bracing, the soil porous, and the accommodation sufficient and excellent; the scenery is beautiful, and there are plenty of gently sloping walks on either side of the valley away from the dusty roads.

Elster (Bad-Elster), in the Kingdom of Saxony (Upper Vogtland).—Elster (altitude 1,550 feet), situated close to the Bohemian frontier in the pleasant valley of the Weisse Elster, is fairly protected from east winds, and has the cool and bracing summer climate of a mountain locality of medium elevation. It possesses cold waters of two classes.

The 'Salzquelle' belongs to the sulphated alkaline group (Flechsigt in 1873 gave 5.2 per mille sulphate of sodium, 1.6 per mille bicarbonate of sodium, 0.8 per mille common salt, 0.06 per mille bicarbonate of iron, and much carbonic acid gas), and is said by Pollach and Flechsigt to rank between the 'Kreuz-Brunnen' and the 'Ferdinands-Brunnen' of Marienbad; the indications for treatment are the same for this spring as for those of Marienbad.

The other springs of Elster are compound chalybeate, and of these the one most used for drinking, 'Marienquelle,' contains 0.06 per mille bicarbonate of iron, 0.7 per mille bicarbonate of sodium, 1.8 per mille common salt, 2.9 per mille sulphate of

sodium, and much carbonic acid gas. Owing to the admixture of laxative saline constituents the Elster chalybeate waters differ in their action from the pure chalybeate waters of Schwalbach, and resemble rather the compound chalybeate waters of Franzensbad. They may be used especially in those cases of anæmia in which there is a tendency to constipation. The 'iron baths' of Elster resemble other gaseous baths in their action, and there are arrangements on Keller's system for artificially increasing the carbonic acid in the baths when required.

The ferruginous moor baths of Elster are prepared from a peaty soil of which there is a plentiful supply in the neighbourhood. They are much in request, and the bath arrangements are admirable.

There are shady walks on the slopes of the Brunnen Berg, &c. The spa life at Elster is similar to that at other large spas where the water is much used internally, and the promenade with music in the morning, whilst sipping the water, forms a characteristic feature. Dietetic methods can be carried out as required. Whey and kephir can be had in the Kur-Garten. The season is from May 1 to September 30. Elster has a station (20 minutes distant) on the railway between Reichenbach and Eger.

Bertrich (Rhenish Prussia).—This spa (altitude 540 feet) has a fairly sheltered position in the beautiful Uesbachthal, a valley in the southern part of the Eifel, which, about $5\frac{1}{2}$ miles below Bertrich, opens into the Moselle Valley opposite to Bullay, a station on the railway between Treves and Coblenz. The spa possesses two tepid springs (91° F.) containing sulphate, bicarbonate, and chloride of sodium, with little free carbonic acid gas. The mineral waters of Bertrich are in their constituents similar to those of Karlsbad (*q.v.*), but only about one-third as strong. According to the analysis by R. Fresenius and E. Hintz in 1890 the solid constituents amount together only to 2.2 per mille. In their internal action they are therefore much weaker than the Karlsbad waters, and approach the indifferent thermal group. Sulphate of sodium is often added when an aperient action is desired. The waters are used internally in dyspepsia, gouty complaints, and the uric acid diathesis. The tepid baths exercise a soothing effect in irritable neuroses. The season lasts from May 1 to the end of September. There are beautiful walks in the neighbourhood.

Rohitsch, Rohitsch - Sauerbrunn, or Heiligen - Kreuzbad (Styria), 3 hours from Cilli and one and a quarter hours' drive from the railway station of Pöltschach, possesses a mild climate and beautiful situation 730 feet above sea-level. Its cold gaseous

springs are rather weak members of the alkaline sulphated group. The Tempel-Brunnen and the Styria-Brunnen are the ones employed for drinking and export; the total solids in the Tempel-Brunnen is about 7·5 per mille, consisting chiefly of sulphate of sodium, and the bicarbonates of sodium, magnesium, and calcium; the Styria-Brunnen is similar, but contains much more bicarbonate of magnesium (4·5 per mille). The amount of common salt in the Rohitsch waters is under 1 per mille.

Though much weaker in sulphates than the cold alkaline sulphated springs of Marienbad, those of Rohitsch are found useful in cases of chronic dyspepsia associated with constipation, chronic gastric and intestinal catarrh, &c. The Tempel-Brunnen can be employed as a dietetic drink with meals. The season is May 1 to the middle of October.

CHAPTER XXII

SULPHATED AND MURIATED SULPHATED WATERS

THE sulphated waters (see Chapter XIV) are much employed for their simple aperient action in constipation and dyspepsia associated with constipation, especially in strong, stout, and full-blooded persons. In regard to their local action on the gastric mucous membrane they are found to diminish its specific secretory activity, though by their high osmotic tension (they are hypertonic¹ to the blood-serum) they may produce a watery flow from the gastric walls, thus increasing the fluid contents of the stomach. A. Bickel's noteworthy experiments on this subject have already been referred to in the introductory portion of Chapter XVIII. Similarly, Esmonet² in experiments on rabbits compared the effect of injecting a very hypertonic sulphated water (Villacabras water, the depression of the freezing point amounting to 2.32° C.) into an artificially isolated loop of intestine with that of a hypotonic water (a Châtel-Guyon spring, with only 0.35° C. depression of freezing point). In the former case, after two hours' interval, the fluid in the loop of intestine was found to have increased to over three times the amount injected; in the latter case it was found to have decreased to half the amount injected.

Since the stronger waters of this class are chiefly used as occasional aperients, they are exported and taken in the patient's home more frequently than at the springs themselves, where, as a rule, there is no proper accommodation for patients. Many persons prefer taking purgative mineral waters to other aperients.

Amongst the best known are FRANZ-JOSEF, HUNYADI-JANOS, *ÆSCULAP*, APENTA, HERCULES, IGMANDI ('Lord Roberts Spring,' near Komarom), and the other 'Hungarian bitter waters;' the RUBINAT and CONDAL waters of Rubinat, and the

¹ This refers to the typical members of the group, including the 'Hungarian bitter waters,' which are likely to be used as occasional aperients. Weaker members of the group are not hypertonic. Püllna waters, for instance, are practically isotonic with blood-serum. Cf. the section on osmotic pressure of mineral waters in Chapter XIII.

² *Bull. et Mémoires de la Soc. de Méd. et de Chir. prat. de Paris*, April 20, 1905; quoted by Lucien-Graux, *Application de la Cryoscopie à l'étude des Eaux Minérales*, Paris, 1905, p. 196.

water of LOËCHES or LA MARGARITA, in Spain; BIRMENSTORF and MÜLLINGEN, in Canton Aargau, near Baden, in Switzerland; PÜLLNA, SEDLITZ,¹ and SAIDSCHITZ, in Bohemia; IVANDA, near Temesvar, in Hungary; GALTHOF, near Brünn, in Moravia; 'Eau Verte' of MONTMIRAIL,² in the Department of Vaucluse, in France. Some of these waters are very strong, that of GRAN, in Hungary, containing $4\frac{1}{2}$ per cent. sulphate of magnesium, and those of RUBINAT and CARABANA,³ in Spain, containing about 10 per cent. sulphate of sodium; VILLACABRAS, a Spanish water, is said to contain 12 per cent. sulphate of sodium; it has the decided effect one would expect such a water to have. Of those mentioned above the weakest are those of Galthof, Sedlitz, and Ivanda.

Little need be said of the English sulphated waters, which have at one time or another been employed. Amongst them are those of Victoria Spa in Warwickshire, Purton Spa in Wiltshire, Cherry Rock in Gloucestershire, Scarborough in Yorkshire, and the original spring (no longer used) at Epsom, from which magnesium sulphate derives its English name, 'Epsom salts.' The sulphated waters near London, of Kilburn, Sydenham Wells, Streatham, Barnet,⁴ and Northaw, were all at one time much employed, those of Streatham till quite recently.

We shall now proceed to the *muriated sulphated* springs. The waters of this group, many of which (as Brides) have a decidedly alkaline reaction, contain a considerable proportion of common salt, sufficient to modify the action of the sulphates. FRIEDRICHSHALL, in Saxe-Meiningen, possesses a bitter water, containing a considerable amount of common salt (24 per mille) and chloride of magnesium (12 per mille), together with sulphate of sodium (18 per mille). The figures given in brackets are those of Prof. Oscar Liebreich; but Justus von Liebig (1846) and Bernhard Fischer (1894) make the proportion of solid constituents less. The mineralisation may have undergone slight natural variations. The common salt in this water is supposed to enable it to be taken for a longer period than other bitter waters without disturbing the digestion or causing depression and emaciation.

¹ The 'Sedlitz powders' of apothecaries are made with tartaric acid (i.e. with Rochelle salts), and therefore, of course, do not imitate the constituents of natural Sedlitz water, except in their laxative action.

² Montmirail likewise possesses sulphurous and weak chalybeate springs.

³ According to Dr. A. Proust's report (Paris, 1885), Carabana water contains 100 per mille sulphate of sodium, 4 per mille sulphate of magnesium, 2·2 per mille of the chlorides of sodium, magnesium, and calcium, and 0·049 per mille of sulphide of sodium.

⁴ In Charles II.'s reign such waters were apparently taken at the wells early in the morning, as laxative saline waters are now usually taken at foreign spas. Pepys, in his Diary, mentions how on a very cold morning, August 11, 1667, at seven o'clock, he found many people drinking the waters at Barnet Wells.

Brides-Salins (France, Savoy) includes the neighbouring spas of **BRIDES-LES-BAINS** and **SALINS-MOUTIERS**. Brides-les-Bains is situated in the deep valley of the Doron,¹ at an elevation of about 1,860 feet above the sea. It is about $3\frac{1}{2}$ miles from the railway station of Moutiers-Salins, and $2\frac{1}{2}$ miles from Salins-Moutiers. The spa is well sheltered from excessive winds, for the direction of the valley is east and west, and at the east it is protected by the Vanoise group of mountains (Grand Bec, &c.), of which there is a good view. The rather weak muriated sulphated springs have a temperature of 96° F., and, according to Willm (1890), contain 1·8 per mille common salt, about 1·2 per mille sulphate of sodium, 0·5 per mille sulphate of magnesium, about 1·7 per mille sulphate of calcium, and a minute quantity of iron and arsenic.

The waters in small doses have a tonic 'eupeptic' action according to Dr. Delastre, but in larger doses have a laxative action. They are used internally in chronic constipation, dyspepsia with constipation, and the uric acid diathesis, and have also been recommended by Delastre in certain gouty forms of albuminuria, and in cases termed 'phosphaturic albuminuria' by Robin, depending rather on a vice of the general nutrition than on any organic change in the kidneys. To some extent they can be employed in hepatic affections, such as are ordinarily treated at Karlsbad (in France, Brides has even been called the 'French Karlsbad'), and in cases of chronic intestinal catarrh, hæmorrhoids, and 'abdominal plethora,' especially in patients of the less robust type. The daily dose required to produce a laxative effect varies much in different individuals: in some cases it is necessary to add a dose of the Brides salts² to produce it. The common salt in these waters renders their action less debilitating than that of ordinary sulphated waters. The Brides waters are also used for baths, but the visitors at Brides often bathe at the neighbouring Salins-Moutiers.

Salins-Moutiers or Moutiers-en-Tarentaise (altitude 1,610 feet) lies lower down in the valley between Brides and Moutiers, about a mile from the railway station. Its muriated waters (temperature 96°) contain, according to Willm (1890), 13 per mille common salt, and a small amount of the sulphates of calcium and magnesium. They are fairly rich in carbonic acid gas, and are used chiefly for baths (single baths, piscines for families, and swimming baths) in scrofulous and rickety children, convalescent

¹ One should say strictly 'Doron de Bozel.' 'Doron' is the word applied to any mountain stream or torrent in the Tarentaise, just as 'Gave' is in part of the Pyrenees.

² What are sold as Brides salts are the salts obtained from the Brides waters, but with the greater part of the common salt removed.

and delicate persons, and for cutaneous affections. The baths are suited for some forms of rheumatism, and can likewise be employed, like those of Nauheim in Germany (*q.v.*), for the treatment of cardiac affections. The 'eau-mère' of Salins-Moutiers, which contains $25\frac{1}{2}$ per cent. common salt and $1\frac{1}{2}$ per cent. sulphate of magnesium, may be used to strengthen the baths if required.

Brides and Salins have excellent arrangements for ordinary hydrotherapeutic treatment, ascending (rectal) douches, box vapour baths (Berthe system), &c. Massage and Swedish gymnastics are employed when required. The resources of the station are great, and the treatment can therefore be varied to suit many different classes of cases.

The well-sheltered Alpine station of Pralognan (4,670 feet) can be reached by a drive of $3\frac{1}{2}$ hours, and is suitable in many cases for an after-cure. The Brides-Salins season is June to September. The station of Moutiers-Salins may be reached during the season in about 23 hours from London *via* Paris.

Saint-Gervais (France, Department of Haute-Savoie).—The spa of Saint-Gervais lies in a gorge 2,075 feet above sea-level, in the neighbourhood of the grand Alpine scenery of Chamonix, with which place it is now connected by electric railway. It possesses three thermal muriated sulphated springs: the Source de Mey (108° F.), the Source de Gontard (102° F.), and the Source du Torrent (102° F.). According to Willm's analysis of 1889, they contain 1.7 per mille sulphate of sodium, 1.7 per mille chloride of sodium, and 0.9 per mille sulphate of calcium. The Source du Torrent is the only one which contains sulphuretted hydrogen. These waters (slightly laxative in large doses) are employed in cutaneous affections, chronic rheumatism, dyspepsia with chronic constipation, &c. According to Egasse and Guyenot the so-called 'chalybeate spring' of Saint-Gervais no longer contains any iron. The season is from June 1 to the end of September. The bath establishment, half-a-mile distant from the railway-station of LE FAYET, has been rebuilt since the disaster of 1892. The climatic resort of SAINT-GERVAIS-VILLAGE (2680 feet) lies higher and gets more sun.

Santenay, in the Département de la Côte-d'Or, has two cold muriated sulphated springs, containing about 5.5 per mille sodium chloride and 2 per mille sodium sulphate. The place has a railway station 3 miles from the junction of Chagny.

Other French muriated sulphated waters but little known are those of CRUZY (Department Hérault), YDES (Department Cantal), and MIERS (Department Lot). The latter water, however, contains very little chlorides, and has an admixture of gypsum.

Leamington (England, Warwickshire).—Leamington (altitude about 200 feet) is situated in one of the most beautiful (though rather flat) and historically interesting parts of England. It is a finely built town, abundantly interspersed with gardens, grassy lawns and trees. Its waters are muriated sulphated, containing a minute quantity of carbonate of iron. The Pump Room stands on the right bank of the river Leam, and on the other side of the road is the Jephson public garden, named after Dr. H. Jephson, to whose management and reputation in the early part of the nineteenth century the development of the spa is largely due. The garden to some extent rivals the 'Kur-Garten' of Continental spas.

According to Prof. Brazier's analysis the water of the 'Public Fount' contains about 8·5 per mille common salt, 1·2 per mille sulphate of sodium, 2·0 per mille sulphate of calcium, and 0·87 per mille sulphate of magnesium. The 'New Well' at the Pump Room (according to A. B. Hill's analysis) is more highly mineralised.

Leamington is often resorted to by those who suffer from chronic hepatic troubles after long residence in hot climates, and for chronic gouty and rheumatic affections and some forms of dyspepsia. The diet should, however, be regulated in most cases. Jephson, who was practically the founder of the health resort, made walking exercise a great part of his treatment.¹ The presence of the sulphates of sodium and magnesium imparts a slightly aperient action to the waters, if as much as a pint is taken in the usual way, that is, in the early morning before breakfast. In suitable cases, besides the internal treatment and baths, massage or douche-massage and various hydrotherapeutic or thermal appliances can be employed; these are useful in the treatment of periarticular adhesions resulting from rheumatism or injuries. The facility for excursions to Warwick, Kenilworth Castle, Stratford-on-Avon &c. is one of the attractions of a stay at Leamington, which is open all the year through, and is likewise a hunting centre. It has been selected for permanent residence by many retired professional men.

Cheltenham (England, Gloucestershire).—Cheltenham (altitude about 150 feet) is a flat town, lying in the Severn Valley and somewhat sheltered from east winds by the Cotswold Hills. It possesses muriated sulphated and chalybeate waters. The chaly-

¹ See the amusing verses relating to Jephson's belief in the value of open-air exercise, as given in the *British Medical Journal*, July 24, 1897, commencing:

'He does, Sir—so much that some have a notion
The secret is his of perpetual motion;
For all his disciples who Jephson obey,
Walk out in all seasons, all hours of the day.'

beate waters are represented by the 'Cambray Chalybeate Spring,' which, according to an old analysis, is said to contain as much as 0.1 per mille of the carbonate of iron (total solids 0.9). According to Prof. T. E. Thorpe's analyses of 1893 (which agree fairly well with analyses made 50 years previously), the 'Lansdowne Terrace (Montpellier) Well' or 'Cheltenham Soda Sulphate Saline' contains about 5.6 per mille common salt, 2.2 sulphate of sodium, and 0.3 sulphate of magnesium (total solids 8.9); the three 'Pittville Wells' or 'Cheltenham Alkaline Waters' have no sulphate of magnesium, but 4.4-7.2 common salt, 1.4-2.1 sodium sulphate, 0.4-0.5 sodium bicarbonate, and 0.01-0.04 sodium silicate (total solids 7.4-9.5); whilst the 'Chadnor Villa Well' ('Cheltenham Magnesia Water') and the 'Cottage Well' have about 1.7 magnesium sulphate, 1.0 sodium sulphate, 1.0 calcium sulphate, 0.4 common salt, and 0.02 sodium silicate (total solids 4.5 and 5.5). The artificially concentrated water of the Chadnor Villa Well is known as 'Cheltenham Natural Aperient Water.' The new 'Central Spa,' where the Montpellier, Pittville and Chadnor Villa waters may be drunk, was inaugurated on June 20, 1906. 'External' treatment can be obtained at the Montpellier Baths, which are under the control of the corporation.

Cheltenham has been looked on as a special resort for 'Old Indians' and persons suffering from prolonged residence in hot climates and also for many with chronic gouty complaints. Owing partly to the competition of foreign spas the town has for many years been far less resorted to for its mineral waters than it was after King George III visited the place for a course of the waters (1788). There are good golf links on Cleve Hill.

Melksham (England, Wiltshire, 13 miles east of Bath, altitude about 110 feet), like Cheltenham and Leamington, possesses muriated sulphated waters. It likewise possesses a chalybeate spring.

Grenzach (Grand Duchy of Baden) lies at the foot of the Niederberg, at an elevation of 920 feet above sea-level, about 4 miles by railway from Bâle. It possesses a cold muriated sulphated water, containing earthy salts, and poor in free carbonic acid gas (according to Bunsen's analysis 3.2 per mille sulphate of sodium, 1.9 common salt, 1.1 sulphate of calcium, 0.7 bicarbonate of calcium), which is made use of in the 'Emilienbad.'

Mergentheim (about 690 feet), in Würtemberg, possesses the Karlsquelle, a cold muriated sulphated spring, rich in carbonic acid gas. This water contains 13.3 per mille common salt, 3.7 per mille sulphate of sodium, and 2.5 per mille sulphate of magnesium. It is employed at the 'Karlsbad' in cases of chronic intestinal catarrh associated with a tendency to constipation, &c.

Hersfeld, an ancient town on the Fulda, in the Prussian Province of Hesse-Nassau, was known to have possessed a medicinal spring near the Johans-Tor. In 1904 this spring was rediscovered by boring, and named after the Anglo-Saxon Abbot Lullus, the founder of the Abbey of Hersfeld. According to the analysis made in the laboratory of R. Fresenius (1905), the Lullusbrunnen contains 2.28 per mille by weight of sodium sulphate, 0.5 common salt, 0.5 calcium sulphate, 0.5 calcium bicarbonate, 0.19 magnesium bicarbonate, and 0.15 bicarbonate of iron. The small quantity of carbonic acid gas in the spring is, however, insufficient to hold the relatively large amount of iron in solution, unless additional carbonic acid gas be added when the bottles are being filled. With the iron retained in this way, the Lullusbrunnen should take a good position amongst compound chalybeate waters. The water freshly obtained from the spring has been shown, like so many other waters, to possess decided radio-active properties.

Salzerbad (Lower Austria) is situated at an altitude of 2,000 feet, near the railway station of Hainfeld. It possesses muriated-sulphated waters (14.1 per mille common salt, 2.8 chloride of calcium, and 4.6 sulphate of sodium) and arrangements for baths.

Bad-Abtenau or **Zwieselbad** (2,100 feet), in a pleasant little valley, near the village of Abtenau, in the Duchy of Salzburg, possesses the muriated-sulphated St. Rupertus spring, which, according to Ludwig, Panzer and Zdarek (1905), contains 3.3 per mille sodium sulphate, 2.6 sodium chloride, and 2.2 calcium chloride (total solids 8.9).

TABLE SHOWING THE AMOUNT OF SULPHATE OF SODIUM AND SULPHATE OF MAGNESIUM, &C. IN SULPHATED, MURIATED-SULPHATED, AND SULPHATED-ALKALINE WATERS

Names of springs	Sodium sulphate per mille	Magnesium sulphate per mille	Other mineral constituents
FRANZ-JOSEF, according to Prof. Attfield	24	24.6	1.6 magnesium chloride, 1.8 calcium sulphate, 1.5 sodium carbonate
HUNYADI-JANOS, according to the 'Lancet,' Dec. 5, 1896	17.3	16.7	1.5 sodium chloride
ÆSCULAP, according to Molnar	13.9	17.2	2.9 sodium chloride, 2.0 calcium sulphate
APENTA, according to Tichborne, 1896	18.6	21	1.7 sodium chloride, 2.6 calcium sulphate
ROYAL HUNGARIAN, according to J. Bernarth	17.8	29	4.4 sodium chloride, 2.7 sodium carbonate
HERCULES	14.1	25.8	0.3 sodium chloride, 1.4 calcium sulphate
IVANDA, according to Ragszky	15.2	—	1.9 magnesium chloride, 3.3 calcium sulphate
CAUCASUS bitter water (near Piatigorsk)	8.33	7.6	2.5 sodium chloride, 2.0 calcium sulphate
GRAN (ESZTERGOM) in former use	—	45	—
PÜLLNA, according to L. Godeffroy ²	9.5	10.8	1.5 calcium sulphate, 2.5 common salt

¹ The analysis by R. Fresenius in 1878 makes the amount of sulphates slightly greater.

² Struve made the amount of the sulphates greater, estimating the chloride of magnesium as 2.3 per mille.

TABLE SHOWING THE AMOUNT OF SULPHATE OF SODIUM &c.—*continued*.

Names of springs	Sodium sulphate per mille	Magnesium sulphate per mille	Other mineral constituents
SEDLITZ	—	13·5	1·4 calcium sulphate
SAIDSCHITZ, according to Berzelius	6	10·9	1·3 calcium sulphate, 3·2 nitrate of magnesium
GALTBOF	4·9	7·4	—
BIRMENSTORF, according to Bolley	7	22	1·2 calcium sulphate
MONTMIRAIL ('Eau Verte') . . .	5	9·3	1·0 mixed chlorides, 1·0 calcium sulphate, 0·5 mixed bicarbonates
CONDAL, according to Paris Ecole des Mines, 1889	44·6	3	1·8 sodium chloride, 1·6 calcium sulphate
RUBINAT	96	3	2·0 sodium chloride, 2·1 other sulphates
CARABANA	100	4	2·2 sodium, magnesium, and calcium chlorides, 0·049 sodium sulphide
VILLACABRAS	122	0·9	0·9 sodium chloride, 2 calcium sulphate
FRIEDRICHSHALL, according to Oscar Liebreich	18·2	—	24 sodium chloride, 12 magnesium chloride
BRIDES-LES-BAINS	1·2	0·5	1·8 sodium chloride, 1·7 calcium sulphate
LEAMINGTON (Public Fount) . .	1·2	0·87	8·5 sodium chloride, 2 calcium sulphate
CHELTHENHAM (Lansdowne Terrace [Montpellier] Well)	2·2	0·7	5·6 sodium chloride (total solids 8·9)
KARLSBAD, in Bohemia (Sprudel)	2·4	—	1·29 sodium carbonate, 1 sodium chloride, 0·003 carbonate of iron
MARIENBAD (Kreuzbrunnen) . .	4·9	—	1·6 sodium bicarbonate, 1·7 sodium chloride, 0·048 bicarbonate of iron
FRANZENSBAD (Salzquelle) . .	2·8	—	0·6 sodium bicarbonate, 1·1 sodium chloride, 0·009 carbonate of iron
TARASP (Luciusquelle)	2·1	—	4·8 sodium bicarbonate, 3·6 sodium chloride, 2·4 calcium bicarbonate, 0·02 bicarbonate of iron
ELSTER (Salzquelle)	5·2	—	1·6 sodium bicarbonate, 0·8 sodium chloride, 0·06 bicarbonate of iron

DOSES.—When only an ordinary aperient effect is required, the smallest amount which is found to exert such an effect is the preferable dose, but this amount differs widely for different individuals. The stronger waters, such as Villacabras, Carabana, Rubinat, and Condal, are taken in doses of one to four ounces (two to eight tablespoonfuls), but sometimes more is required. One to five ounces of the Hungarian bitter waters (Hunyadi-Janos, &c.) or of the Friedrichshall is a usual dose, but double the amount is often necessary. The ordinary dose of Püllna and Said-schitz is a tumblerful of about ten ounces.

CHAPTER XXIII

IRON OR CHALYBEATE WATERS

IRON waters (see also Chapter XIV) are useful in various forms of anæmia, especially those due to some previous acute illness or actual loss of blood. Those containing bicarbonate of iron with carbonic acid gas are more likely to be well borne by the stomach than those containing the more active protosulphate and persulphate. A tendency to constipation, when simply due to debility, is no contra-indication; but in cases when there is dyspepsia with intestinal catarrh, or a tendency to hepatic disorder, their use is better preceded or accompanied by that of muriated or sulphated alkaline waters, or aperient drugs. In this way they have often to be used in the ordinary chlorosis of girls, as well as in malarial cachexia, or cachexia from residence in tropical climates. Iron waters are contra-indicated in feverish conditions, in severe disturbance of the digestive organs, in plethoric conditions and tendency to hæmorrhages, and in severe diseases of the cardio-vascular system. Chalybeate waters have by some been regarded as contra-indicated for consumptive patients, but according to O. Liebreich¹ this view is not quite correct, though he agrees that they are absolutely to be avoided in all cases of pulmonary tuberculosis in which hæmoptysis has been observed.

C. Genth² found that courses of gaseous chalybeate waters (like most mineral waters) are able to exert a diuretic influence, and that they may also cause an increased excretion of urea. Vandeweyer and Wybauw³ find that during the use of these waters the absorption from the alimentary canal of nitrogenous and carbohydrate foods is increased, whereas that of fatty foods is diminished. These observers, like Genth, find that the treatment promotes the proteid catabolism of the body, as evidenced

¹ *Therapeutische Monatshefte*, Berlin, April 1906, p. 171.

² See *Deut. Med. Wochenschrift*, 1887, No. 46; and *Practitioner*, London, July 1898.

³ See Vandeweyer and Wybauw, 'Ueber die Wirkung der Stahlwässer auf den Stoffwechsel,' *Muenchener Med. Wochenschrift*, 1906, No. 24, p. 1152; and *Zeitschr. für phys. und diät. Therapie*, Leipzig, Nov. 1906, p. 453.

by the greater excretion of urea. Because of these changes in anabolism and catabolism they recommend that when chalybeate waters are being employed, the diet should consist chiefly of easily digestible proteid and carbohydrate foods, but, like several older authors whom they mention, they advise that it should be poor in fats.

Owing to the improvement in the quality of the blood and in the general nutrition of the body, functional nervous affections, neuralgias, sterility, and impotency, when dependent on general debility, are often remedied by the use of these waters.

'Iron baths,' such as those of Spa and Schwalbach, owe their principal effect to the mechanical stimulation of the skin by the bubbles of carbonic acid gas (see Chapter XIV). In baths containing sulphate of iron a useful astringent effect may be exerted on the vagina of women with leucorrhœa, and on the skin of persons with great tendency to sweating. Thermal chalybeate waters, such as some of the springs at Lamalou (in France), Sciacca (in Sicily), Szliacs and Vihnye (in Hungary),¹ and the weaker chalybeate springs of Rennes-les-Bains (in France) and Jelesnovodsk (in Russia), when used in the form of baths, act doubtless mainly as simple thermal waters, unless they contain abundance of carbonic acid gas, the bubbles of which mechanically stimulate the skin.

In bottled chalybeate waters, especially in those containing bicarbonate of iron, unless especial precautions during the bottling be employed, a good deal of the iron is, after some time, deposited on the sides of the bottle in the form of an insoluble oxide.² For therapeutic purposes,³ therefore, before each bottle is used, it is necessary to ascertain that the iron in the contents has not yet been precipitated and rendered insoluble. The exact conditions which determine the time and amount of this precipitation have been already the subject of careful investigations. According to Oscar Adler,⁴ the precipitation is much accelerated by the agency of certain microbes, present in great numbers in the deposits on the sides of the bottles. By a suitable method of sterilisation (without loss of carbonic acid gas, which would favour precipitation) and by careful closure of the bottles it would perhaps be possible to preserve bottled chalybeate waters for a much longer time.

¹ With these waters the thermal chalybeate springs (120° F.) of Caledon, in South Africa (Cape Colony), may be compared.

² Apparently in some chalybeate waters (independently of the amount of carbonic acid gas?) this precipitate occurs less readily than in others, as tested by the artificial introduction of oxygen to accelerate the precipitation of the oxide. See O. Liebreich, *Therapeutische Monatshefte*, Berlin, April 1906, p. 170.

³ See Professor C. Binz, 'Die Gehalt natürlicher Eisenwässer an gelöstem Eisen,' *Deut. med. Wochenschrift*, 1901, No. 14.

⁴ O. Adler, 'Biologische Untersuchungen von natürlichem Eisenwasser,' *Deut. med. Wochenschrift*, 1901, Nos. 26 and 52.

Amongst chalybeate spas, Spa, Schwalbach, and St. Moritz, some of the best known of this group, will be described first. The others will be considered in the political geographical order previously made use of, excepting the sulphate of iron waters, which will be mentioned at the end of the chapter. The present chapter, it must be mentioned, besides the regular chalybeate spas, contains descriptions of a few health resorts known rather for their ferruginous 'moor baths' than for the use of mineral water springs.

Spa (Belgium, Province of Liège).—Spa was such a noted and fashionable health resort in the seventeenth and eighteenth centuries¹ that England adopted its name as a generic term for places frequented on account of the therapeutic virtues of their waters. Unlike many other spas, whose reputation was formerly great, the original spa has maintained its fame as a health resort, though at one time it appeared to be mainly frequented for its gaming tables and its social amusements. The gambling tables at Spa and Ostend were finally suppressed at the end of 1902 by the new Belgian law on the subject. The town is situated in a sheltered valley of the Ardennes at an elevation of about 1,000 feet above the sea-level; it is beautifully laid out with promenades and avenues, and is surrounded by wooded hills with delightful shady walks, where the fresh air and charming views encourage exercise.

The waters may be classed with those of Schwalbach &c. as comparatively pure chalybeate, containing a considerable amount of the bicarbonate of iron and a large amount of free carbonic acid gas. The latter makes them pleasant to most people, in spite of a faint trace of sulphuretted hydrogen. The springs chiefly used for drinking are the two situated within the town, of which the 'Pouhon de Pierre le Grand'² contains, according to Professor G. Dewalque, of Liège, 0.092 per mille³ bicarbonate of iron, whilst the 'Pouhon du Prince de Condé' is stated to contain more. The water is cold, and in order that the carbonic acid gas shall not escape it is often not warmed, as at St. Moritz, but it is

¹ H. Schaltin even (*Congrès National d'Hygiène et de Climatologie Médicale de la Belgique*, Brussels, 1898, p. 185) thinks that it is to the chalybeate water of Spa, and not to the spring at Tongeren, that Pliny's description refers: 'fontem habet insignem, multis bullis stillantem, ferruginei saporis.'

² 'Pouhon' is, according to Dr. R. Wybauw, a general Walloon term for chalybeate springs.

³ The different analyses appear to have given very different results. The amount of bicarbonate of iron in the 'Pouhon de Pierre le Grand' is variously given as 0.07 to 0.19 per mille; the amount in the 'Pouhon du Prince de Condé' is stated to be 0.27 per mille. Of the chalybeate springs situated two or three miles out of the town, that of Géronstère contains, according to Dewalque, 0.05 per mille, and that of Barisart only 0.04 per mille.

recommended to suck in the water through a glass tube, so as to insure that the stomach is not disagreeably chilled by the sudden swallowing of a glass of cold water. It is only as a precaution against this that the glass tube is of any use, and is not required to protect the teeth, as is commonly supposed.

In former times enormous quantities of the water were drunk, but now the amount recommended rarely exceeds 30 ounces daily, and smaller quantities are taken at the commencement of the 'cure.' The best time for taking the waters, in the majority of cases, is in the early morning on an empty stomach, between six and eight o'clock; and at this time, in the freshness of the morning, in the beautiful 'Promenade de Sept Heures,' the patients can really enjoy the stroll between their glasses. Many exceptions are, however, made to this rule. Part of the daily dose may be taken in the forenoon before lunch, or in the afternoon before dinner. Excursions may be made from Spa, and the water of one of the beautifully situated springs in the neighbourhood may be drunk instead of that of the centrally situated springs. At present, however, the neighbouring springs of Sauvenière, Géronstère, Tonnelet, and Barisart are probably more visited by tourists than by actual patients. Very weak patients may have a little milk or a little coffee or a biscuit before drinking the waters, or may take the waters before lunch or dinner instead of in the early morning. Only in rare cases or in bad weather should the waters be taken in the patient's room or hotel.

The affections chiefly treated at Spa are chlorosis and anæmia in women; menorrhagia, a disposition to abortion, and other conditions, if dependent on a feeble general state of health; atonic dyspepsia or a simple tendency to diarrhœa in anæmic persons; anæmic and debilitated conditions resulting from prolonged residence in the East, and from past disease of various kinds. In leucorrhœa and relaxed conditions of the female pelvic organs the baths are employed, and treatment at Spa has a reputation in cases of sterility when dependent on poor general health, and local catarrhal conditions of the uterus.

The bathing establishment at Spa is one of the finest and best arranged ones in Europe, and the bath rooms have the advantage of being large and airy. The establishment is supplied with mineral water by a special spring. The chalybeate baths are considered to act chiefly by the large amount of carbonic acid gas, i.e. the mechanical effect which the bubbles of this gas (as in other gaseous 'iron baths') exert on the nerve-endings in the skin. By an outer chamber, at the bottom of the bath, the waters can be heated to any temperature required, without driving

out too much of the gas. Much valued by the doctors at Spa is the hip bath of warm running water, in which the water is heated by a special apparatus before the patient enters; this is especially used in leucorrhœa and female pelvic disorders; the vagina can be kept open by a wire speculum, which the patient can herself introduce, to facilitate the contact of the moving water with every part of the vagina during the bath. There are excellent arrangements for cold douches and other hydrotherapeutic methods, for 'moor baths' (similar to those at Franzensbad, &c.), and for electric light ('radiant heat') baths, &c. The gaseous baths of Spa are also recommended by Dr. Cafferata and others for treatment of cardiac cases, after the Nauheim methods. The ordinary iron baths are much used in chlorosis and anæmia, and aid the beneficial effect of taking the waters internally. Sometimes the waters are much better borne internally after a preliminary course of baths. Dr. Scheuer recommended that, when possible, the bath should be taken early in the morning, the patient rising at six and taking the bath before drinking the waters. The baths are employed hot for patients having muscular rheumatism, back-ache, or various neuralgic pains; afterwards they may be taken cooler, and finally the more stimulating cold water treatment may be substituted; the cold wet sheet may sometimes be used as a transitional treatment before commencing the cold douches. Occasionally the skin does not react to the mechanical stimulation of the iron (gaseous) baths, and the more powerful treatment by cold water douches is to be preferred from the commencement; in a few cases the ordinary iron baths produce too much irritation.

Constipation, when produced by drinking the waters, can be rectified by a dose of some imported Hungarian 'bitter water' or other laxative. At the commencement of the cure, neuralgic pains may be increased, and as this exacerbation soon passes away, temporary recourse may sometimes be had to opiates (subcutaneously or otherwise). In some cases ordinary pharmaceutical treatment may be combined with that by the Spa waters; thus anti-syphilitic methods may be tried when the anæmia is partly due to old syphilis; quinine and arsenic in malarial cases, &c. Regarding contra-indications it may be stated as a general rule that patients inclined to corpulence with 'abdominal plethora,' those who are 'full-blooded,' and those with considerable arterial degeneration or heart disease, are unsuitable for treatment at Spa. Season, from May to October. Spa can now be reached by quick service from London in 11 hours.

Schwalbach, Germany (Prussian Province of Hesse-Nassau).—Schwalbach, officially called LANGENSCHWALBACH, to distinguish

it from other Schwalbachs, lies at an altitude of about 950 feet in a branch of the Aar Valley, in the northern part of the Taunus range. It is a long narrow town, the upper south-western portion of which is more modern and comfortable, and constitutes the spa proper.

The waters are cold, strong, fairly pure chalybeate, with excess of free carbonic acid gas and scarcely a trace of sulphuretted hydrogen. Of the different springs, the Stahlbrunnen and the Weinbrunnen are the most used internally. The Stahlbrunnen (total solids, only 0·6 per mille) contains more iron, 0·08 per mille of the bicarbonate to the 0·06 per mille in the Weinbrunnen (total solids, 1·5 per mille). Minute quantities of bicarbonate of manganese are also present in both these waters. The 'Lindenbrunnen,' one of the springs used for baths, contains only 0·01 per mille bicarbonate of iron, and may be classed with the simple gaseous waters. Schwalbach is a very popular spa, especially amongst the English and Americans.

The 'iron baths' owe their effect, as at Spa, to the mechanical stimulation of the skin by bubbles of carbonic acid gas. The baths are made of copper, so that the water can be heated with steam from a chamber at the bottom, and that the least possible loss of carbonic acid gas takes place. Peat baths are likewise given; the peat, obtained in the neighbourhood, is mixed with the mineral water, and, when employed, heated with steam to the required temperature. The peat baths are often useful before the ordinary 'iron baths' are commenced, but patients must rest after them to avoid fatigue. The ordinary iron baths may be used somewhat cooler as the patient gets better, and reaction takes place more readily. Massage and ordinary hydrotherapeutic treatment can be employed in suitable cases. For visitors to Schwalbach able to take active open-air exercise golf links have now been provided.

The affections treated at Schwalbach are chlorosis in girls and young women, anæmic conditions and retarded convalescence in men and women, leucorrhœa and chronic inflammatory conditions of the female pelvic organs, and disorders of the digestive system when partially or wholly dependent on a general state of anæmia or debility. In leucorrhœa vaginal douches of the mineral water are employed, as well as the baths. The best time for taking the waters is after the baths in the forenoon, or in the early morning before breakfast: respecting this, however, the doctors are guided much by the strength and previous habits of their patients. Sometimes the water is recommended to be taken at the midday meal with or without the addition of a white

wine. Massage of the abdomen may be useful in some cases to counteract the constipating action of the water.

St. Moritz, Switzerland (Grisons).—St. Moritz-Bad (altitude 5,800 feet), in the Valley of the Upper Engadine, is situated on the level ground at the south-western border of the Lake of St. Moritz between this lake and the Lake of Campfer. It is here that the springs rise. St. Moritz-Dorf lies on a higher ground (altitude 6,100 feet), about $1\frac{1}{4}$ miles distant from the baths. Those that drink the waters can stay at either the village or the baths of St. Moritz (they are connected by an electric tramway), but for many years the village has possessed a special importance of its own as a climatic winter health resort for tuberculous and neurasthenic patients, and the air at the village is on the whole more bracing than that in the immediate neighbourhood of the springs. Campfer is likewise a good place to stay at.

There are three different cold chalybeate springs, all rich in carbonic acid gas: the Altequelle, or Badequelle; the Neuequelle, also named Paracelsus-Quelle, in honour of Paracelsus, who in his writings mentioned the waters of St. Moritz; and the more recently discovered Surpunt-Quelle. The first two of these contain 0.033 and 0.041 per mille bicarbonate of iron, 0.27 and 0.18 per mille bicarbonate of sodium, and about 1.2 per mille bicarbonate of calcium (total solids, 1.5 and 1.7 per mille); the third spring contains rather more iron and less total solids (1.2 per mille) than the first two springs.

Owing to the amount of carbonic acid gas, the water of St. Moritz is pleasant to the taste; it may be taken by those who are strong enough in the morning before breakfast, or else in the forenoon about an hour before the midday meal, or in the afternoon a couple of hours after; sometimes it is taken with meals. Iron (i.e. effervescent) baths are employed as at other chalybeate spas, and hydrotherapeutic treatment can likewise be obtained.

When compared with the springs of Schwalbach &c. those of St. Moritz are relatively weak in iron and scarcely representative of the chalybeate group, but owing to the climatic advantages of the place they are more effective in many cases than stronger springs at lower situations. On the other hand, there are nervous, excitable patients, who are not suited for the high altitude and dryness of the air of St. Moritz, which, owing to a certain amount of wind, is even more bracing than that of Davos; anæmic patients with renal disease should not be sent to St. Moritz. (In regard to contra-indications for high altitudes see also Part I, Chapter II.) In the case of debilitated patients, or those with excitable vasomotor system, it is advisable to rest some time preliminarily at an intermediate station of somewhat lower altitude, such as

Churwalden, Parpan, Savognin (German, Schweiningen), or Bergün. The summer season, or rather, the spa-season at St. Moritz, is June 15 to September 15. For St. Moritz as a summer and winter high altitude climatic resort see Part I, Chapter VII.

Tunbridge Wells, England, Kent.—The water of Tunbridge Wells (altitude about 420 feet) belongs to the pure chalybeate class, and, according to the analysis by Dr. Y. Stevenson in 1892, contains about 0·06 per mille carbonate of iron. The chalybeate spring was accidentally discovered in 1606 by Dudley, third Baron North, whose health improved much during the time he made use of it. After some time a village grew up around the spring, and the spa was a most fashionable resort in the eighteenth century, when Bath was at the height of its prosperity. It is now a very popular health resort, and still crowded with visitors, but only a few come to drink the waters. There are open commons at Tunbridge Wells and in the neighbourhood, with excellent opportunity for walking exercise and golfing, an important point in the case of the robust visitors. Many pleasant and interesting excursions may be made into the surrounding country.

The pump-room and 'Pantiles' (an old-fashioned arcade of shops) are situated in a hollow, and one has to descend to get to them from any other part of the town. The waters are only employed internally, and do not contain the carbonic acid gas so important in the internal and external use of the foreign chalybeate waters of Schwalbach, St. Moritz, &c.

Doubtless the climate (see Part I) largely contributes to the benefit derived by anæmic and enfeebled persons at Tunbridge Wells. In bad cases of chlorosis the climate should be assisted by pharmaceutical preparations, especially if the mineral water seems not to agree. The chief season for Tunbridge Wells is from June to September.

Other English Chalybeate Waters

Stafford and Saltburn, which have been mentioned amongst brine baths (Chapter XVIII), likewise possess chalybeate waters. So do Cheltenham and Melksham, which have been mentioned amongst the muriated sulphated waters (Chapter XXII); Harrogate, described in the sulphur class (Chapter XXV); and Buxton, described in the simple thermal group (Chapter XVII). The Shanklin chalybeate water, according to Professor J. Attfield's analysis of 1896, has a total of 0·38 solid constituents per mille, and contains 0·068 per mille carbonate of iron.

Amongst other chalybeate waters which are known or have been known in England, one may mention: Flitwick Well, near

Amptill, in Bedfordshire (whose ferric sulphate waters¹ are sold in bottles); Sandrock, near Blackgang Chine, in the Isle of Wight (containing alum); Gilsland Spa (the sulphur waters are mentioned in Chapter XIV), in Cumberland; Horley Green, near Halifax, in Yorkshire; St. Ann's Well, at Brighton, in Sussex; Dorton, in Buckinghamshire; and the recently discovered Lady Ida Well, at Knockin, in Shropshire; all of these are sulphate of iron waters. Amongst the chalybeate or supposed chalybeate springs nearer London some of the following were formerly well known: Dulwich Spa; Hampstead Wells; Shadwell² Spa, near the Tower of London; Bagnigge Wells, near King's Cross; Sadler's Wells, or the 'New Tunbridge Wells,' at Islington; Hoxton, Coldbath Wells, and Bermondsey Spa. Readers of the books by Dr. J. Macpherson and Dr. A. B. Granville on the spas of England will find some interesting information about these once more or less interesting springs.³ Some of them are discussed in 'A Treatise on the Origin, Nature, and Virtues of Chalybeate Waters,' by D. W. Linden (first edition, London, 1748), a German physician, who was likewise the first to write on the waters of Llandrindod in Wales. We are not sure whether the waters of Sunninghill, in the Windsor district of Berkshire, and St. Rumbald's Well, at Astrop, in Northamptonshire, were chalybeate. Both were known to the philosopher John Locke, who was physician to the first Earl of Shaftesbury.

In Scotland the chalybeate springs at Vicar's Bridge, near Dollar, and the Hartfell Spa, near Moffat (*q.v.*), may be mentioned as examples of sulphate of iron springs. Trefriw Wells, in North Wales, a mile from Trefriw, amidst the beautiful scenery of the Vale of Conway, contain, according to Hassall's analysis, much protosulphate of iron (5·4 per mille in Trefriw water No. 1) and sulphate of aluminium (0·7 per mille in No. 1). King Arthur's Well, 5 miles from Carnarvon, contains, according to Muspratt, 0·05 per mille carbonate of iron.

Ireland has chalybeate springs at Castleconnell (County Limerick), Ballyspellan (County Kilkenny), Tralee Spa (on the north shore of Tralee Bay, County Kerry), and Lisdoonvarna (see Chapter XXV).

Haarlem, in Holland, possesses the cold muriated chalybeate 'Wilhelmina' spring, containing 3·2 per mille common salt

¹ According to an analysis made for the *Lancet* (*Lancet*, October 24, 1891, p. 951), the Flitwick water contains 2·4 per mille ferric sulphate (persulphate of iron).

² Shadwell apparently derived its name from an older 'St. Chad's Well.' Another St. Chad's Well at Battle Bridge (now King's Cross) seems not to have been chalybeate, but to have had a slightly aperient action, like the neighbouring St. Pancras' Well, also resorted to in the eighteenth century.

³ See also Warwick Wroth, *The London Pleasure Gardens of the Eighteenth Century*, London, 1896.

according to Gunning's analysis. The spring, which arises some little distance from the town, is conducted to a spot close to the Kurhaus and to the entrance of the beautiful park of Haarlem. The water is rather poor in free CO_2 , but an artificially aerated table water ('Hollandia Bron') is made from it. At Zaandam, in Holland, there is likewise a muriated chalybeate water (the Elisabeth spring), which is exported in bottles (0.11 per mille bicarbonate of iron).

Cudowa, or Kudowa (in Prussian Silesia), lies at the side of a broad elevated valley (about 1,310 feet above sea-level) near the Bohemian border. A wooded slope immediately adjoins and shelters the spa on the north. Its cold alkaline chalybeate waters, which are employed for both internal and external treatment, are rich in carbonic acid gas. The Eugen-Quelle is richest in iron, and, according to P. Jeserich, contains 0.06 per mille bicarbonate of iron, 1.29 per mille bicarbonate of sodium, and 0.0025 arseniate of iron. The Gotthold-Quelle, though much weaker in iron and arsenic, contains 0.018 per mille bicarbonate of lithium. The pure air of the place doubtless favours the action of the chalybeate springs in cases of anæmia and convalescence. The effervescent gaseous baths ('iron baths') of Cudowa are indicated in many debilitated conditions, and, like other gaseous baths, may be of service in various forms of cardiac weakness. Ferruginous 'moor baths,' carbonic acid gas baths, and treatment by milk, whey or kephir can also be obtained. Pleasant shady walks may be taken in the park and on the wooded hill close by. Longer excursions may be made to the spa of Reinerz, the rocks of the Heuscheuer, &c. The nearest railway station is Nachod, 4 miles distant, on the Breslau and Prague line.

Reinerz, in Prussian Silesia.—Bad Reinerz (altitude 1,860 feet) is pleasantly situated, close to the town of Reinerz, in a valley (running north and south) of the mountainous county of Glatz, a district rich in mineral springs. Of the three very gaseous springs used for drinking, the so-called 'Laue Quelle' (temperature 65.1°F.) is the richest in iron (0.036 per mille bicarbonate of iron) and the one most generally employed. The water is often taken mixed with whey. The other two springs ('Kalk-Quelle' and 'Ulriken-Quelle') are considerably less mineralised, have a lower temperature, and are less generally prescribed. All three springs contain traces of arsenic according to the Breslau analysis of 1897. Ferruginous moor baths (regular peat baths) and hydrotherapeutics are employed, as well as gaseous iron baths, according to individual indications. Reinerz is a suitable locality for a milk, whey, or kephir cure. Its tonic climate of moderate humidity and its shady walks make an excellent

resort in many cases of debility and convalescence from acute diseases, and in some chronic affections of the respiratory organs. The promenades and walks in the neighbourhood can be used for a 'Terrain-Cur' after Oertel's methods. The place is much resorted to by patients with chronic non-febrile or quiescent pulmonary tuberculosis. Railway stations: Rückers-Reinerz (5 miles), Nachod (12½ miles), Glatz (17 miles).

Langenau, or **Niederlangenau** (Prussian Silesia), likewise in the county of Glatz, has a sheltered position in a pleasant valley, 1,170 feet above sea-level. According to Poleck (1883) the cold gaseous chalybeate 'Emilienquelle' contains 0.049 per mille bicarbonate of iron. Ferruginous moor baths (peat baths) and hydrotherapeutic treatment are likewise made use of. This quiet health resort is a quarter of an hour from the railway station of Langenau.

Flinsberg (Prussian Silesia) lies on the Queis-Thal, on the northern slope of the Tafelfichte, at an altitude of 1,720 feet. It possesses cold gaseous chalybeate springs, of which the two used for drinking contain about 0.04 per mille bicarbonate of iron. In the neighbourhood are walks suitable for a 'Terrain-Cur,' after Oertel's methods. The place lies in the midst of a pine forest, and has a stimulant and refreshing climate. The railway station is Friedeberg (an hour's drive).

Schmiedeberg (Prussian Province of Saxony) may be mentioned in this chapter on account of its ferruginous moor baths, although it possesses no mineral water. The place is situated on level ground (altitude 260 feet) with pleasant wooded hills in its neighbourhood. It has a railway station on the line between Eilenburg and Pretzsch, and can be reached in 2 hours from Leipzig. The moor baths are employed in chronic rheumatism, chronic rheumatoid arthritis, sciatica and gouty and rheumatic neuritis, some chronic affections of the female pelvic organs, &c.

Cleve, in Rhenish Prussia, close to the Dutch boundary, formerly capital of the Duchy of Cleve, possesses a non-effervescent chalybeate spring, and arrangements for hydrotherapeutic treatment. The place, however, is better known as a mild and equable climatic health resort, pleasantly situated in the lower Rhine district, with beautiful woodland walks and comfortable accommodation. The elevation of the hills of Cleves (altitude about 180 feet), though not great, is of importance owing to the flatness of the surrounding country; the extensive views obtained from the ancient castle and from some of the hotels constitute an attraction in themselves.

Godesberg, in Rhenish Prussia, is a favourite summer resort and place for hydrotherapeutic treatment on the Rhine, 4 miles above (to the south of) Bonn. It possesses two gaseous chalybeate springs, of which the 'old' one contains 0.029 per mille bicarbonate of iron, with 1.4 bicarbonate of sodium and about 1.0 common salt, whilst the 'new' spring, only used for bathing, contains more iron (0.05 per mille of the bicarbonate) and less other solid constituents.

Lamscheid (Rhenish Prussia), a village situated on the Hunsrück, near Boppard-on-the-Rhine, possesses the 'Lamscheider Stahlbrunnen' or 'Emma-Heilquelle.' The cold gaseous chalybeate water of this spring, which has also been called 'Leininger Wasser,' is largely exported in bottles. It contains 0.07 per mille bicarbonate of iron and something like 1590 per mille volumes of free carbonic acid; according to O. Liebreich,¹ it 'keeps' much better than many other chalybeate waters and is therefore particularly suitable for home use.

Driburg, in Prussia (Province of Westphalia).—This spa lies at an elevation of 730 feet in a pleasant valley of the Teutoburg Forest. Of its cold alkaline earthy chalybeate springs the 'Hauptquelle' is the strongest, and, according to R. Fresenius (1866), contains 0.07 per mille bicarbonate of iron, 1.4 per mille bicarbonate of calcium, 1 per mille sulphate of calcium, and much free carbonic acid gas. The Hersterquelle contains only 0.02 bicarbonate of iron. The Caspar-Heinrich-Quelle contains a smaller total of solids, but more carbonic acid gas; it may be compared to the 'Georg-Victor-Quelle,' in Wildungen. The Wiedenquellen, very rich in carbonic acid gas, are used for baths; with these and the other springs gaseous baths can be given, more or less effervescent, to suit individual indications. A peat, very rich in sulphur from the Saatz sulphur spring, is used for 'moor baths.' The affections treated at Driburg comprise anæmic and debilitated conditions of various kinds, chronic inflammation of the pelvic organs, and chronic catarrhal affections of the bladder and urinary system. As at most other health resorts known for their chalybeate springs and moor baths, the majority of patients are of the female sex.

Bad Driburg (i.e. the old establishment, the 'Von Sierstorpff-Crammsches Bad') contains abundant accommodation for visitors, and is situated in extensive and well-wooded grounds. The small 'Kaiser Wilhelm Bad' has also chalybeate waters of its own. There are plenty of shady walks with opportunity for gentle climbing exercise on the wooded slopes around Driburg, and there

¹ 'Ueber den Lamscheider Stahlbrunnen,' *Therapeutische Monatshefte*, Berlin, 1906, p. 167.

are also pleasant longer excursions to be made in the neighbourhood. The station of Driburg is on the railway between Holzminden and Altenbeken, 5 miles from Altenbeken. The season is May 1 to October 15.

Freienwalde, on the Oder (Prussia), in Mark Brandenburg, is a summer resort of the people of Berlin, and possesses chalybeate waters (Königsquelle) with 0.02 per mille carbonate of iron, poor in carbonic acid gas. Ferruginous moor baths are employed.

Neustadt-Eberswalde, or **Eberswalde** (Prussia), situated in a beautiful region of Mark Brandenburg (altitude 100 feet), is a summer resort, and contains chalybeate waters poor in carbonic acid gas.

Bibra (altitude 410 feet), a small summer health resort in Prussian Saxony, possesses weakly mineralised chalybeate springs.

Pyrmont, in Germany (Principality of Waldeck-Pyrmont).—This is one of the oldest chalybeate spas of Europe, and lies at an altitude of about 420 feet in the beautiful valley of the Emmer, sheltered by the surrounding wooded hills, notably on the north side. It possesses cold chalybeate ('Stahlwasser') and cold muriated ('Salzwasser') springs.

Of the chalybeate springs the two chief ones used for drinking (Hauptquelle and Helenen-Quelle) contain, according to Fresenius (1864), about 0.07 and 0.03 per mille bicarbonate of iron, 1 per mille bicarbonate of calcium, 0.8 sulphate of calcium, and 0.5 sulphate of magnesium; they are both rich in free carbonic acid gas, but the Brodel-Brunnen used for baths is still richer, containing about 1,540 volumes per mille of carbonic acid gas. The chalybeate water of Pyrmont is by no means an unpleasant effervescent drink. It is often mixed with a little of the muriated water (usually warmed) from the Trinkquelle, or sometimes with a little fresh whey or milk, which can always be obtained in the morning.

The muriated waters of Pyrmont contain, according to Wiggers, from 7 ('Trinkquelle') to 32 ('Bohrlochsoole') per mille common salt. The 'New Well' contains less common salt (1 per mille) than the others, but has 0.05 per mille carbonate of iron.

The bath arrangements are good. Baths are given both of the common salt waters and of the gaseous iron waters. The ferruginous peat of Pyrmont is made use of in a separate establishment for 'moor baths.' The muriated water establishment is at some little distance from the others, but may be reached by omnibus.

By means of the two classes of waters patients can be treated at Pyrmont for anæmia, debility, scrofulous conditions, functional nervous affections, &c. As at most chalybeate spas the majority

of patients are of the female sex. It is, however, interesting to note that Pymont has a great reputation amongst peasants from the neighbourhood of Bückeberg, who flock thither like colliers from the Rhondda Valley flock to, or used to flock to, Llanwrtyd Wells in Wales.

The avenues, Kurpark, pretty villas, and surrounding hills give Pymont a very bright and cheerful appearance. There are pleasant shady paths on the Bomberg (1,010 feet, funicular railway) and other neighbouring slopes, so that graduated climbing exercise may be practised. Longer excursions may be made to the old town of Hameln, to Detmold, and the Arminius monument, &c. Living in Pymont is not very expensive. This spa was amongst the earliest foreign spas to get a reputation in England, but has lately not been very much frequented by the English. It is much resorted to by Hanoverian families. The season is from the beginning of May to the end of September.

Alexisbad (Germany, Duchy of Anhalt) lies in the Selkethal, a very beautiful valley of the lower Harz Mountains, and has a station on the railway from Gernrode to Hasselfelde. The Alexis-Brunnen (total solids 0·5 per mille) contains 0·04 per mille bicarbonate of iron and 0·02 bicarbonate of manganese, but is poor in free carbonic acid gas; in most cases the water is artificially charged with CO₂ for internal use. The Selke-Brunnen, containing chloride (0·1 per mille) and sulphate (0·05 per mille) of iron, is used for baths. The spa has a sheltered and sequestered position, at an altitude of about 1,080 feet above the sea-level; it is probably more visited as a summer resort than for its mineral waters. The air is fresh and the relative humidity considerable, and there are pleasant shady walks in the neighbouring woods. The season lasts from the beginning of June to September 15.

Berka, on the Ilm (altitude 770 feet), a climatic health resort in the Grand Duchy of Weimar, possesses weak chalybeate waters (not much used). There are arrangements for pine baths, 'moor baths,' hot sand baths, &c. The place is pleasantly situated in a broad valley amidst wooded hills, which form a part of the Thuringian Forest. On the Emskopf, one of these wooded eminences, about 2 miles distant, is the Thuringian Sanatorium for poor consumptives. The railway station of Berka is reached in 1 hour from Weimar.

Liebenstein (Duchy of Saxe-Meiningen), in the western part of the Thüringer Wald, lies at an altitude of 1,450 feet, and is well sheltered on the north and east by the neighbouring heights. It contains two gaseous alkaline earthy chalybeate springs. The 'Neuequelle,' according to Reichard (1870), contains 0·08 per mille bicarbonate of iron; this is the one used for drinking, and

its richness in carbonic acid gas makes it pleasant to the taste. The other one, the 'Altequelle,' is said to contain even more iron (0.104 per mille of the bicarbonate; total solids 1.4 per mille), but less free carbonic acid gas. Besides gaseous iron baths, all kinds of hydrotherapeutic treatment can be obtained, and salt baths are prepared at Liebenstein with salt or 'Mutterlauge' from the neighbouring spa of Salzungen.

The indications for Liebenstein are not merely those for chalybeate waters. The moderate elevation, sheltered position, and fairly equable climate of medium humidity make Liebenstein an excellent climatic resort in some chronic affections of the respiratory organs, and for residence after courses of active mineral waters elsewhere. Its position below a wooded eminence crowned by the picturesque ruins of the old castle of Liebenstein, the pleasant walks in the adjoining forest, the beautiful surrounding scenery, and the facilities for excursions contribute to its popularity. It is especially visited by North Germans. The season is from the middle of May to the end of September.

Imnau (Germany), in the Principality of Hohenzollern, is pleasantly situated in the Valley of the Eyach, at an elevation of 1,140 feet above the sea. Of its cold gaseous chalybeate springs the richest is the Kasper-Quelle, which contains 0.05 per mille bicarbonate of iron, 0.03 per mille bicarbonate of manganese, and 1.4 per mille bicarbonate of calcium. The Fürsten-Quelle, likewise rich in carbonic acid gas, contains only about 0.01 per mille bicarbonate of iron. Imnau is reached in half an hour from the railway station of Eyach.

Auerbach (Grand Duchy of Hesse) is a pleasant summer resort (330 feet) of the western declivity of the Odenwald. In the grounds of the 'Fürstenlager' there is a gaseous rather weak chalybeate spring. Many interesting excursions can be made in the neighbourhood.

Rippoldsau (Rippold's-Au), Grand Duchy of Baden. Rippoldsau (altitude 1,856 feet, the best known of the 'Kniebis spas') lies in a narrow part of the Wolfthal at the southern foot of the Kniebis Mountain. The scenery is typical of a thickly wooded Black Forest valley. Three springs are used for drinking: the 'Wenzels-Quelle,' the 'Josephs-Quelle,' and the 'Leopolds-Quelle.' Their waters, according to Bunsen, contain 0.03 to 0.09 per mille bicarbonate of iron, about 1.0 per mille bicarbonate of calcium, and rather less than 1.0 of sulphate of sodium; they are cold and rich in carbonic acid gas. From the Josephs-Quelle and the Leopolds-Quelle gaseous sulphated alkaline mineral waters have been artificially prepared by the addition of sodium carbonate and carbonic acid gas; they are respectively called 'Natroine' (2.3 per

mille bicarbonate of sodium and 2·4 of sulphate of sodium), and 'Schwefelnatroine' (2·2 per mille bicarbonate of sodium, 1·7 sulphate of sodium, and a little sulphuretted hydrogen gas), and are said to resemble respectively the Kreuz-Brunnen water of Marienbad, and the Schwefelbrunnen water of Weilbach. The chalybeate waters are taken internally in anæmia and the complications of anæmia. The 'natroine' is intended for use to counteract a tendency to constipation. For the 'iron baths,' two springs are used somewhat poorer in iron, but richer in carbonic acid gas, than the springs used for drinking. Hydrotherapy and 'moor baths,' made with peat from Franzensbad, in Bohemia, are likewise employed. The season is from May 15 to September 30. The railway station of Wolfach is 2½ hours' drive distant.

Antogast, Germany (Baden), the oldest of the 'Kniebis spas,' is situated in the Black Forest at an elevation of 1,640 feet, half an hour's drive from the railway station of Oppenau. It possesses three alkaline earthy gaseous chalybeate springs. According to Bunsen (1871), the Trinkquelle and the Antoniusquelle contain respectively 0·04 and 0·03 per mille bicarbonate of iron with a total of 3 per mille solids. The forest air favours the action of the iron in the waters, which have an old popular reputation in the neighbourhood for atonic dyspepsia &c.

Freiersbach, in the Black Forest (Grand Duchy of Baden), likewise one of the 'Kniebis group' of spas, lies in the Renchthal at an elevation of 1,260 feet. Of its cold gaseous alkaline earthy chalybeate springs, the 'Friedrichsquelle' contains 0·058 per mille bicarbonate of iron, and 0·013 per mille chloride of lithium; the 'Lithionquelle' contains less iron but more chloride of lithium (0·017 per mille); the 'Schwefelquelle,' smelling of sulphuretted hydrogen, is richest in iron (0·1 per mille of the bicarbonate). The springs all contain 0·5 to 1·5 per mille bicarbonate of calcium. Oppenau, 4½ miles distant, is the nearest railway station.

Griesbach, or **Griessbach** (Grand Duchy of Baden), lies in the Black Forest at an elevation of 1,850 feet. This, too, is one of the group of Renchthal or Kniebis spas, and possesses cold gaseous chalybeate waters, of which the 'Antoniusquelle' used for drinking is the strongest, and, according to Bunsen's analysis, contains 0·07 per mille bicarbonate of iron, 1·6 bicarbonate of calcium, and 0·7 sulphate of sodium. The railway station of Oppenau is 7½ miles off.

Petersthal. (Grand Duchy of Baden), in the Black Forest, lies at an elevation of 1,330 feet in the Renchthal on the western slope of the Kniebis mountain, 5 miles from the railway station of Oppenau. Its various cold gaseous chalybeate springs contain, according to Bunte and Rupp (1891), about 0·045 per mille

bicarbonate of iron, 1·5 per mille bicarbonate of calcium, and 0·7 per mille sulphate of sodium.

Teinach, a summer resort in a sheltered valley of the Würtemberg Black Forest, lies at an elevation of 1,310 feet under the Zavelstein. It possesses chalybeate springs and gaseous weakly mineralised alkaline waters used as ordinary table waters. There is a hydrotherapeutic establishment, and comfortable accommodation can be had.

Alexandersbad (Bavaria), on the south-eastern slope of the Fichtelgebirge, near the stations of Markt-Redwitz and Wunsiedel, possesses a cold very gaseous chalybeate spring with about 0·06 per mille bicarbonate of iron (Leitzemayer's analysis of 1882); it is used for drinking and bathing. There are likewise arrangements for peat and pine baths &c. The spa is situated near the Luisenburg, at an elevation of 1,915 feet above the sea. It can be used as a climatic health resort, or 'after-cure' for patients returning from Karlsbad and Marienbad. The hydrotherapeutic establishment is well known. Season: May 15 to October.

König-Otto-Bad (1,680 feet), in the north-eastern region of Bavaria, little more than a mile from the railway station of **Wiesau**, is situated on one of the southern slopes of the Fichtelgebirge, and derives its name from the late King Otto of Greece. It possesses four chalybeate springs and arrangements for ferruginous moor baths. The Ottoquelle, according to Hilger and Metzger (1890), contains 0·1 per mille bicarbonate of iron, with 0·005 per mille bicarbonate of manganese and a little arsenic.

Steben, one of the oldest spas of Bavaria, is situated on the plateau of the Franconian Forest, at an altitude of about 1,950 feet, half an hour's drive from the railway station of Marxgrün-Steben. The two cold very gaseous chalybeate springs, according to Hilger's analysis of 1889, contain respectively 0·05 and 0·06 per mille bicarbonate of iron, with a minute amount of bicarbonate of manganese. Ferruginous moor baths are made use of. The bathing arrangements and accommodation are good.

Bruckenaue, in Bavaria (altitude 980 feet), is beautifully situated on the south-west of the Rhöngebirge, amidst forests of beech and oak. It is a four hours' drive from Kissingen. The 'Stahlquelle' is a cold weak chalybeate spring (0·011 per mille carbonate of iron), rich in carbonic acid gas. Besides this, there are two other springs, the Wernarzerquelle and the Sinnbergerquelle. Both the Wernarzer and Sinnberger waters are much exported, the latter as a simple acidulated or 'table' water, the former (containing 1·5 per mille calcium bicarbonate) as an alkaline earthy acidulated water, suitable in many renal cases.

Ferruginous peat baths and gaseous 'iron baths' are likewise made use of at Brückenau. The season lasts from May 15 to September 30.

Bocklet, in Bavaria, about $4\frac{1}{2}$ miles' drive from Kissingen, in a wooded and protected situation (altitude 690 feet), possesses a compound iron spring, the 'Stahlquelle,' the waters of which contain bicarbonate of iron (0.088 per mille), common salt (1 per mille), and much free carbonic acid gas (temperature 50° F.). There is also a less employed chalybeate spring with traces of sulphuretted hydrogen gas. The spa is of use for various anæmic and debilitated patients; also sometimes for an 'after-cure,' following treatment at Kissingen. Ferruginous moor baths are employed. The season is from May 15 to the end of September.

Bad-Kohlgrub is situated in the Bavarian Mountains, not far from Ober-Ammergau, celebrated for the survival of mediæval passion plays. It combines the advantage of an elevated position (2,950 feet above sea-level) with that of possessing chalybeate springs. The latter are, however, poor in carbonic acid gas. Ferruginous moor baths are likewise employed.

Augustusbad, in the kingdom of Saxony, lies at an elevation of about 720 feet amidst pine woods, half an hour from the railway station of Radeberg. It possesses chalybeate waters (0.02 to 0.03 per mille bicarbonate of iron), rather poor in free CO_2 , and facilities for hydrotherapy. Ferruginous moor baths are employed. The spa is reached from Dresden in less than an hour.

Elster (Germany, kingdom of Saxony) possesses important compound iron waters, in which the action of the iron is modified by sulphate of sodium, &c. Elster has already been described in the sulphated alkaline group. (See Chapter XXIII.)

Schandau (Germany, kingdom of Saxony) is pleasantly situated (altitude 400 feet) on the Elbe in the country called the 'Saxon Switzerland.' There is sufficient accommodation, and the place is used as a summer resort. Its weak chalybeate spring contains 0.015 per mille bicarbonate of iron and 0.24 per mille bicarbonate of calcium.

Johannisbrunn (Meltscher Bad), in Austrian Silesia, lies at an altitude of 1,320 feet in the sheltered Mohrathal, surrounded by the pine-clad slopes of offshoots of the Sudetic range. Its gaseous chalybeate springs contain 0.08 to 0.09 per mille bicarbonate of iron. The railway station of Troppau is about three-quarters of an hour distant by carriage.

Rabbi (altitude 4,100 feet), in Tyrol, lies in the Val di Rabbi, a branch of the Val di Noce. It possesses two strong alkaline iron springs, the stronger of which (the new one) is said to contain about 0.18 per mille bicarbonate of iron and 1 per mille bicarbonate

of sodium. The nearest railway station is San Michele (10 hours distant). The season is from the middle of June to the middle of September.

Pejo, in Tyrol, lies in the Pejo Valley to the south of the Ortler district at 4,430 feet above sea-level. It possesses an alkaline chalybeate spring containing, according to Bizio, 0.05 per mille bicarbonate of iron. The nearest railway station is San Michele (12 hours' drive).

Sanct Lorenz, in Upper Styria, possesses muriated alkaline chalybeate springs, which have been already mentioned in Chapter XX amongst the muriated alkaline waters.

Franzensbad (Bohemia).—This spa, some of whose springs, especially the Neuquelle and the Stahlquelle, yield important compound chalybeate waters, has been described in the chapter on sulphated alkaline waters (see Chapter XXI), to which group most of its springs belong.

Marienbad, in Bohemia, possesses the gaseous chalybeate springs, Ambrosiusbrunnen and Karolinenbrunnen, which have been already referred to in the description of the spa in Chapter XXI.

Liebwerda (altitude 1,420 feet), in the north of Bohemia, lies on the south-western slope of the Tafelfichte, half an hour distant from the railway station of Raspenau-Liebwerda. It possesses the cold gaseous 'Stahlbrunnen,' which contains 0.03 per mille bicarbonate of iron. The 'Christians-brunnen' is a weakly mineralised alkaline earthy gaseous spring, which can be used as a 'table water' with meals or as a simple refreshing draught. Ferruginous moor baths are likewise employed.

Koenigswart, a health resort in Bohemia (altitude 2,230 feet), is a railway station on the line from Eger to Pilsen, 5 miles before the station of Marienbad. The Kurhaus lies on a wooded hill half an hour's drive from the station. The cold gaseous chalybeate springs are said to contain 0.08 per mille bicarbonate of iron. The Ricardsquelle is a simple gaseous spring. Moor baths are made use of. The position on a mountain slope looking towards the south and the purity of the air are favourable conditions for the treatment of anæmia and convalescence, and for an after-cure to courses of mineral waters at Marienbad, Franzensbad, &c.

Krynica (Galicia) is beautifully situated in the Carpathians at an altitude of about 2,000 feet, and possesses cold gaseous alkaline-earthly chalybeate waters, which are used for anæmic patients with atonic dyspepsia &c. The Hauptquelle contains 1.3 per mille carbonate of calcium and 0.029 carbonate of iron.

The bathing arrangements and accommodation are satisfactory. The nearest railway station is about 1 hour distant.

Szliacs, near Altsohl, in Hungary (Comitat Zolyom), has a beautiful position on a wooded plateau, 1,180 feet above sea-level. It possesses thermal gaseous alkaline earthy chalybeate springs, four of which (temperatures 77°–91.4° F.) are used for baths (piscinæ). The indications include not only those for the internal use of chalybeate waters, but likewise those for warm and tepid gaseous baths (compare the remarks on the thermal chalybeate baths of Lamalou, in France, further on in the present chapter). The season is from the middle of May to the end of September.

Vihnye (1,015 feet), in Hungary, 7½ miles from Schemnitz, possesses thermal gaseous alkaline earthy chalybeate waters (95°–101° F.) used for baths. The thermal establishment is good, and there are also facilities for ordinary hydrotherapy.

Lucski (1,970 feet), pleasantly situated in the Hungarian Comitat Lipto, possesses thermal alkaline earthy chalybeate waters (85.1°–88.7° F.).

Buzias (Hungary) is pleasantly situated at an altitude of about 420 feet, in hilly country, 3½ hours distant from the railway station of Temesvar. Its alkaline chalybeate springs are very gaseous, and the strongest are said to contain over 0.1 per mille bicarbonate of iron.

Koritnicza or **Korytnicza** (Hungary) is situated at an altitude of 2,790 feet in a valley of the Carpathians (Lower Tatra) amidst pine-clad slopes, two hours distant from the railway station of Rosenberg. It possesses gaseous alkaline earthy sulphated chalybeate waters. The Bela spring is said to contain 0.1 per mille bicarbonate of iron, 0.8 calcium bicarbonate, 0.7 calcium sulphate, and 1.2 magnesium sulphate. There are arrangements for ferruginous 'moor baths,' for ordinary hydrotherapy, and for whey cures.

Bartfa (**Bartfeld**) (1,000 feet), in Hungary (Comitat Saros), lies in a wooded valley at the foot of a spur of the Carpathians. It possesses several cold gaseous muriated alkaline chalybeate springs, containing a small amount of iodide of sodium. The 'Doctorquelle' has 4.8 per mille bicarbonate of sodium, 1.1 per mille common salt, 0.05 per mille bicarbonate of iron, and 0.001 per mille iodide of sodium. The 'Hauptquelle' with a total of 3.5 per mille solids (chiefly bicarbonate of sodium) is said to contain 0.08 per mille carbonate of iron. The establishment is good, and there are also arrangements for hydrotherapeutic treatment. Anæmic conditions, especially those associated with scrofula or with dyspeptic symptoms, are treated here. The spa

is five hours distant from the nearest railway station, Eperies, and half an hour from the town of Bartfeld.

Előpatak, or Arapatak (Transylvania), possesses cold gaseous alkaline earthy chalybeate waters, rich in free carbonic acid gas. It is perhaps the most frequented spa in Transylvania, and lies in a pleasant sheltered valley, $12\frac{1}{2}$ miles distant from Kronstadt, at an elevation of about 2,030 feet above sea-level. The two chief springs contain 0.09 per mille bicarbonate of iron, and about 1 per mille bicarbonate of sodium, 1.5 per mille bicarbonate of calcium, and 1.5 per mille bicarbonate of magnesium. The waters are taken in chlorosis and in menstrual and digestive disorders of anæmic persons. Hydrotherapeutic processes can be likewise employed. The season lasts from the middle of May to the end of September.

Borszek, a Transylvanian health resort, is situated at an altitude of about 2,890 feet in the Carpathian Mountains, near the Roumanian frontier, and possesses cold gaseous alkaline earthy chalybeate springs, of which the Kossuthquelle (about 5 per mille of the mixed bicarbonates of calcium, magnesium, and sodium, with 0.09 per mille bicarbonate of iron) is richest in iron. The Hauptbrunnen, which is exported in bottles, may be classed in the simple gaseous group. Moor baths are made use of at Borszek.

Amongst other chalybeate (bicarbonate of iron) waters in Germany and Austria may be mentioned those of: SOULTZBACH, or SULZBACH, in Alsace; HITZACKER-WEINBERG,¹ in Hanover; MALMEDY, in Rhenish Prussia, near Belgium; the DINKHOLDER-BRUNNEN, near Braubach, on the Rhine; ALBERSDORF, on the Baltic Canal (ferruginous baths and hydrotherapeutic establishment); HOFGEISMAR, in the Prussian Province of Hesse-Nassau (rather weak); STETTIN and POLZIN, in Pomerania (poor in CO_2); RONNEBURG, in the Duchy of Saxe-Altenburg (rather poor in CO_2); LOBENSTEIN (chalybeate waters rather poor in CO_2 , ferruginous moor baths), in the Principality of Reuss-Schleiz, in the Thuringian Forest, at an altitude of 1,650 feet; NIEDERNAU, in the Würtemberg Black Forest; RASTENBERG, in Thuringia (Saxe-Weimar); LAUCHSTÄDT (poor in CO_2), near Merseburg (Prussian Saxony); REIBOLDSGRÜN, better known for its sanatorium for consumptive patients (altitude 2,300 feet), in the kingdom of Saxony; KELLBERG, in Bavaria; CHARLOTTENBRUNN (weak), BUKOWINE, ALT-HAIDE, HERMSDORF, near Goldberg, and SCHWARZBACH (weak), in Prussian Silesia; KARLSBRUNN (altitude

¹ The gaseous muriated alkaline Juventa spring near Hitzacker is exported to England as a table water, though, according to the analysis of Dr. Ulex in 1895, it seems to be more highly mineralised than most waters used in this way.

2,520 feet), in Austrian Silesia; STERNBERG, NEUDORF (CONSTANTINSBAD), ZEIDLWEID, and SANGERBERG (the last three not far from Marienbad), in Bohemia; MATTIGBAD, in Upper Austria; PYRAWARTH (0.11 per mille bicarbonate of iron, but comparatively weak in CO_2), in Lower Austria; VELLACH, or FELLACH (altitude 2,750 feet), in Carinthia; TARCSA, or TATZMANNSDORF (with about 0.5 per mille sulphate of sodium, 1.5 per mille bicarbonate of calcium, and 1.2 per mille bicarbonate of sodium), in Hungary, near the borders of Lower Austria and Styria; BALDOCZ (the gaseous alkaline earthy chalybeate Deakquelle), in the Zips Comitatus, and RANK-HERLEIN (with gaseous alkaline chalybeate springs, one of which, the so-called Springbrunnen, is a remarkable intermittently spiring artesian fountain), 2½ hours' drive from the railway station of Kaschau, both of these localities in Hungary; and ZAIZON (see Chapter XXVII), TUSNAD, and RODNA, in Transylvania. Not far from Tusnad is the 'Stinkberg' of Torja ('Torjai büdös') with various mineral springs and a remarkable sulphurous cavern.¹ This neighbourhood is somewhat analogous to the Agnano and Solfatara districts near Naples and Pozzuoli, in Italy (see Chapter XX), and to the Le Montet district at Cransac, in France (see Chapter XXVI).

ALTWASSER, in Prussian Silesia, was well known as a chalybeate spa up to 1869, in which year the springs were greatly damaged by the coal-mining work.

Acquarossa (Switzerland, Canton Ticino), at an altitude of 1,150 feet, is beautifully situated amongst high mountains, in the Val Blenio, about 1½ hours' drive from the station of Biasca on the Italian side of the St. Gothard railway. The waters have a temperature of 77° F., and, according to Koerner's analysis, contain 0.034 per mille bicarbonate of iron, 0.019 bicarbonate of manganese, 0.00024 arseniate of calcium, 0.0025 borate of magnesium, 0.0046 chloride of lithium, and 1.1 sulphate of calcium. (The total of solids is 2.5 per mille.) The waters deposit a red ferruginous muddy material, from which they have derived their name, and which is heated and applied externally in the treatment of chronic cutaneous affections.

Tarasp (Switzerland, Grisons) possesses compound chalybeate springs, of which the 'Bonifaciusquelle' is the strongest, containing 0.045 per mille bicarbonate of iron, together with bicarbonates of sodium and calcium. See Chapter XXI, where Tarasp is described amongst the sulphated alkaline group.

¹ This cavern besides a little sulphuretted hydrogen contains a layer of carbonic acid gas, which makes it an enlarged version of the Italian 'Grotta del Cane.'

The waters of **Val Sinestra**, near Tarasp, are classed in the arsenical group (Chapter XXIV).

Tiefenkasten and **Solis**, near **Alveneu** (Switzerland, Grisons), possess sulphated alkaline chalybeate springs. These are referred to under **ALVENEU** amongst sulphur waters (Chapter XXV).

Andeer-Pignieu.—Andeer, in Switzerland (Grisons), lies in the Schamserthal at an altitude of 3,200 feet, about 3 hours' drive from the railway station of Thusis. The water of the neighbouring spring at Pignieu is conducted to Andeer; it is a weakly mineralised gypsum water (1·7 per mille sulphate of calcium), containing a small amount of bicarbonate of iron (temperature 66°–68° F.). Ferruginous mud baths are likewise made use of. The season is a short one, namely, from the middle of June to the end of September.

San Bernardino (Switzerland, Grisons) is situated at an altitude of 5,320 feet, on the San Bernardino Pass from Splügen to Bellinzona, about 11 hours by diligence from the railway station of Chur and 7½ from Bellinzona. Its cold gaseous earthy chalybeate spring, according to Planta's analysis, contains 0·035 per mille bicarbonate of iron, 0·01 bicarbonate of strontium, and 1·2 sulphate of calcium, the total of solid constituents being 2·59 per mille. Accommodation is satisfactory. The mountain climate has naturally to be considered in regard to the effects of treatment.

Bad Fideris (Switzerland, Canton Grisons) lies at an altitude of 3,580 feet in the Praetigau Valley, 1 hour from the station of Fideris on the railway between Landquart and Davos. It possesses gaseous weak alkaline earthy chalybeate waters (0·01 per mille bicarbonate of iron, with a total of 1·9 solids per mille), resembling the class of 'table waters.' The climate plays a chief part in the treatment.

Fideris enjoyed a considerable reputation in olden times, and there is a long history attached to the place. Dr. Conrad Gessner, of Zürich, visited it in 1553, and Huggelius, of Basel, in his '*Von heilsamen Bädern des Teutschenlands*,' published in 1559, wrote of Fideris (as quoted by Gsell-Fels): 'Fideris ist auch ein sehr gut Bad, das wärmet man; es ist von einem schlichten Bauersmann erfunden worden, der darin gebadet und sich wohl dabei gefunden. Derselbe hat es also ausgebracht und gerühmt, dass der Römische König das Bad gebauen und aufgebracht hat. Es ist von Art sauer und kalt, gar lieblich zu trinken, man trinkt es kalt oder warm, so schadets Niemand, liegt auch nicht über die Brust, sondern fördert die Dauung, ist gut dem Magenweh, dient gegen das Fieber und Herzgesperr, löscht aus das hitzig zornig Blut, hilft und heilt das Podagra u. a.; wo einer zu viel Geld im Seckel hat, dem hilft es auch geschwind, dass er sein ledig wird'

Other chalybeate springs in Switzerland are those of PASSUGG (Chapter XIX); FARNBÜHL (altitude 2,310 feet), in Canton Lucern, an hour from the railway station of Malters; GONTEN (altitude 2,900 feet), in Canton Appenzell; ROTHENBRUNNEN, in Canton Grisons, with a weakly mineralised compound chalybeate water, and an elevation of 2,000 feet above sea-level; MORGINS-LES-BAINS, in Canton Valais, $3\frac{1}{2}$ hours' drive from the railway station of Monthey, with the high elevation of 4,300 feet, but with 2·4 per mille sulphate of calcium in its waters. GIMEL, a summer resort on the south-eastern declivity of the Jura Mountains (2,400 feet above sea-level), 5 miles from Aubonne, has a chalybeate spring, which is poor in free carbonic acid gas; some of this gas is therefore added to the water during the process of bottling.

Lamalou (France, Department of Hérault) lies at an altitude of 620 feet, in a valley of the southern part of the Cevennes Mountains. The climate is mild, though it is not completely sheltered from cold winds. The springs are situated in three groups, at no great distance from each other: Lamalou-le-Bas, Lamalou-le-Centre, Lamalou-le-Haut; they have temperatures ranging from 59° to 117° F., and are chalybeate and weak alkaline, containing a moderate amount of carbonic acid gas. Each group of springs has its own thermal establishment; that of Lamalou-le-Bas (Lamalou l'ancien) being the most elaborate.

The 'Source Capus' of Lamalou-le-Centre (temperature 59° F.) is the most chalybeate, containing about 0·06 per mille bicarbonate of iron and 0·001 per mille arseniate of sodium. It is the most used for drinking in anæmic cases, but has very little carbonic acid gas, and does not keep sufficiently well for exportation. The so-called 'Source Petit-Vichy' (temperature 61·5° F.) of Lamalou-le-Haut has very little iron and a total of only 1 per mille solids (carbonate of sodium, &c.). The SOURCE DE LA VERNIÈRE, situated near the railway station, about a quarter of a mile south of Lamalou-le-Bas, contains 1·1 per mille bicarbonate of sodium, 0·5 per mille bicarbonate of calcium, and 0·2 per mille bicarbonate of magnesium. It is cold and comparatively rich in carbonic acid gas, so that although it contains as much as 0·014 per mille bicarbonate of iron, it forms an agreeable refreshing draught, and is exported in bottles for table use, &c.

The above-mentioned springs are used for drinking, but Lamalou is probably better known for its baths, given at 87·8° to 96·8° F. A favourite custom is for several patients to take their baths together in the same 'piscine' (as in the so-called 'family piscines' at various Continental resorts). There are likewise arrangements for douches, vapour baths (for which the natural thermal springs of Lamalou-le-Bas are sufficient), and

trained attendants for supplying massage. Patients can have rooms adjoining the baths, and can be carried the short distance on chairs if they desire it.

Lamalou is resorted to for chronic rheumatism, sciatica and various forms of neuritis, incipient tabes dorsalis, and chronic affections of the nervous system. There are arrangements at Lamalou for the treatment of ataxia by exercises, according to the method introduced (1890) by Frenkel of Heiden. The late Professor Charcot sent many nervous cases to this health resort. The season is from May 15 to October 15.

Bagnères-de-Bigorre (France, Hautes-Pyrénées) possesses some chalybeate springs. This spa is described in the earthy group (see Chapter XXVI).

Rennes-les-Bains (France, Department of Aude).—The village is situated in a narrow valley at an altitude of 1,040 feet on the banks of the River Salz, 6 miles from the railway station of Couiza-Montazels.

Amongst its thermal weak chalybeate springs the hottest is the 'Source du Bain Fort' (temperature 115° F.), which, according to Willm¹ (1890), contains only 0·002 per mille bicarbonate of iron, and has a total mineralisation of only 0·54 per mille; it might therefore with other similar springs at Rennes be classed in the simple thermal group.

A second class of mineral waters is constituted by the Source du Cercle (temperature 54° F.), the Sources Madeleine, and other springs at Rennes, which, according to Willm, contain sulphate of iron (0·15 per mille in the Source Madeleine No. 1), sulphate of aluminium, and a little free sulphuric acid.

A third class of waters at Rennes includes various muriated springs, which run into the Salz stream and have caused it to receive its name. One of the springs contains as much as 56 per mille common salt.

The Rennes waters are made use of for anæmia, chronic rheumatic and scrofulous affections, &c.

Barbotan (France, Gers), a quiet village (altitude 260 feet) near Cazaubon, 19 miles from the railway station of Mézin, has a chalybeate spring (64·4° F.) and several thermal sulphurous springs (91°–98·6° F.). The mud baths, which constitute the speciality of Barbotan, are used in chronic rheumatic and gouty

¹ These waters, according to Willm's analysis, contain scarcely enough iron to be termed chalybeate; otherwise they would probably be the hottest chalybeate waters in Europe. Compare the thermal chalybeate waters of Lamalou in France, of Sciacca in Sicily, of Szliacs and Vihnye in Hungary, and of Caledon in South Africa; but especially the thermal weak chalybeate springs (68°–112° F.) of Jelesnovodsk, in Russia.

affections and the remains of injuries to bones and joints. The spa is visited mostly by patients from the neighbouring parts of France.

La Bauche (France, Department of Savoie).—Its cold, non-gaseous, chalybeate water, which is exported, is said to contain 0·14 per mille bicarbonate of iron, and 0·03 per mille crenate of iron; it tastes, however, almost like ordinary spring water. There are arrangements for baths and hydrotherapeutic treatment at the little establishment. The position of La Bauche is most charming; it lies at an altitude of about 1,640 feet in a broad fertile valley, with the rocky cliffs of the L'Epine mountain on the east, and with a view of the Grande Chartreuse mountains on the south. The railway station of Les Echelles and that of Lépin are both about 3 miles off.

Charbonnières (France, Rhone); a village 5 miles north-west of Lyons, possesses cold chalybeate waters (0·04 per mille bicarbonate of iron), poor in free carbonic acid gas.

Luxeuil (France, Haute Saône) has been already described amongst the simple thermal spas. (See Chapter XVII.)

Châteauneuf (France, Puy-de-Dôme).—Some of the colder springs, such as the 'Source Morny,' may be classed as chalybeate. The spa has been described in the simple alkaline group (Chapter XIX).

Renlaigue, at Saint-Dierry, in the Department of Puy-de-Dôme, is distinguished amongst French waters as a fairly pure, strong, and gaseous chalybeate. According to Mialhe, it contains 0·08 per mille bicarbonate of iron.

Forges-les-Eaux¹ (France, Department of Seine-Inférieure).—The town (altitude 525 feet) lies on the railway from Paris to Dieppe, *via* Pontoise, and owed its reputation to the visit in 1632 of Louis XIII. with his wife Anne of Austria, and his famous minister Cardinal Richelieu. The waters (cold) of the 'Source Cardinale' contain, according to O. Henry, 0·098 per mille crenate of iron, with minute quantities of alum and earthy salts; they are poor in free carbonic acid gas.

Orezza lies at an altitude of 1,960 feet amongst the mountains of the north-eastern part of the island of Corsica. It possesses two gaseous chalybeate springs, sometimes, however, containing a little sulphuretted hydrogen.

The following French bicarbonate of iron waters have not yet been mentioned: NEYRAC (weak alkaline earthy chalybeate, to 80° F.) and LE PESTRIN, in Department Ardèche, near Aubenas and Vals; FARETTE (weak, and poor in CO₂), in Department

¹ This must not be confused with Forges-les-Bains (in the Department Seine-et-Oise). The latter possesses feebly mineralised cold waters.

Savoie; **ORIOLE** (gaseous alkaline earthy chalybeate), near Grenoble, in Department Isère; **SAINT-BERTRAND-DE-COMMINGES** (0·05 per mille, non-gaseous), in Department Haute Garonne; **CLERMONT-FERRAND** (with common salt and bicarbonates of sodium and calcium), in Department Puy-de-Dôme; **CHÂTEAU-GONTIER** (0·104 per mille, according to O. Henry, of the carbonate and crenate of iron), in Department Mayenne; **BRUCOURT** (non-gaseous, with about 0·5 per mille sulphate of magnesium), in Department Calvados. **VIC-SUR-CÈRE**, **SYLVANÈS**, and **BUSSANG** are described in the arsenical group (Chapter XXIV).

Santa Catarina (Upper Italy).—About 3 miles from Bormio, at an altitude of about 5,600 feet, has strong chalybeate waters, with a climate analogous to that of St. Moritz, in the Upper Engadine.

Recoaro (Italy, Province of Vicenza), lies at an altitude of 1,400 feet, to the south of the Tyrolese Alps, at the head of the Val d'Agno, and is about 26 miles from the railway station of Vicenza, with which it is connected by a steam tramway. Of its many chalybeate springs the best known is the 'Lelia,' which, according to Bizio, contains 0·046 per mille carbonate of iron, together with small amounts of carbonate of calcium and of the sulphates of calcium and magnesium; it is rich in carbonic acid gas. Recoaro is likewise a summer resort and centre for excursions. The surroundings are picturesque and the accommodation good. In the neighbourhood are the sulphate of iron waters of **CIVILLINA**, **VEGRI DI VALDAGNO**, &c. According to Bizio (1878), the Civillina waters contain 3·21 per mille ferrous sulphate, 1·28 sulphate of aluminium, 0·02 sulphate of manganese, 0·001 sulphate of copper, 1·3 sulphate of calcium, and 0·008 arseniate of iron, with a small amount of free sulphuric acid.

Ceresole Reale, in Italy (Piedmont), is described in the arsenical group (Chapter XXIV).

Sciaccia, in Sicily, possesses thermal slightly gaseous alkaline chalybeate waters, which are mentioned together with its sulphur waters in Chapter XXV.

Lanjaron and **Graena**, in the Province of Granada, in Spain, have alkaline chalybeate waters. They are situated in hilly country between 2,000 and 3,000 feet above sea-level.

St. Olafs is close to **Modum**, a popular health resort in Norway. It is picturesquely situated at an altitude of about 500 feet, and has a carbonate of iron spring, poor in carbonic acid gas. Mud baths are employed.

In the Caucasus (Russia) are the thermal chalybeate springs of **Jelesnovodsk**, pleasantly situated amongst forests on the southern slope of a hill called Jelesnui Hill (i.e. the 'Iron Hill'). The

temperature of the springs is 68° to 112° F., but as the amounts of carbonate of iron given by Dr. F. G. Clemow vary from 0·007 to 0·01 per mille, it seems probable that some at least of the springs would be better classed in the simple thermal group. The springs may, however, be compared to some of those of Rennes-les-Bains and Lamalou, in France (*q.v.*).

Lipetsk (Russia, Tambof) lies picturesquely on the River Voronezh, and has cold chalybeate waters and ferruginous peat baths, compared by Dr. Clemow to those of Franzensbad.

We shall now consider foreign *waters containing sulphate of iron*, the English ones having been already mentioned amongst English chalybeate waters.

Hermannsbad, at **Muskau**, in Prussian Silesia.—Muskau (altitude 320 feet), on the Neisse, in the Oberlausitz, a station on the branch railway from Weisswasser, possesses cold sulphate of iron waters. The 'Trinkquelle' is said to contain about 0·19 per mille sulphate of iron, 0·24 per mille bicarbonate of iron, and 0·5 per mille sulphate of calcium, whilst the stronger 'Badequelle' has 0·75 sulphate of iron, 0·54 bicarbonate of iron, and 2·08 sulphate of calcium. Ferruginous 'moor baths' constitute an important part of the means of treatment at Bad Muskau. Milk, whey and kephir can likewise be employed. Hermannsbad lies in the middle of the celebrated park and gardens of Prince Pückler.

Hermannsbad, near **Lausigk**, in the kingdom of Saxony, possesses strong sulphate of iron waters (over 4 per mille), containing some arsenic. They are unsuitable for internal use, but they are employed for baths, with or without peat. The altitude of Bad Lausigk is 615 feet.

Alexisbad (Duchy of Anhalt), in the Lower Harz Mountains, has been already described in this chapter amongst the ordinary chalybeate, (bicarbonate of iron) spas.

Ratzes (Austria, Tyrol, altitude 3,900 feet) lies in a wooded ravine close to the Schlern Mountain. It possesses a sulphate of iron spring (0·3 per mille sulphate of iron), and a cold sulphur spring. The nearest railway station, Atzwang, is 3¼ hours distant.

Mitterbad (Austria, Tyrol, altitude 3,110 feet), 3½ hours distant from Meran, lies in the romantic Marau Valley, and possesses a chalybeate spring, containing sulphate of iron, with minute quantities of arsenic and of the sulphates of manganese, strontium, zinc, and copper.

Parad (Hungary, altitude 660 feet), a station on the railway from Kis-Terenne to Kaal-Kapolna, possesses sulphate of iron waters, the strongest of which is said to contain 5·5 per mille

sulphate of iron, and 3·03 per mille sulphate of aluminium. In the neighbourhood is the Csevicezequelle, a sulphurous spring containing 1·1 per mille carbonate of sodium, much carbonic acid gas, and ten volumes per mille sulphuretted hydrogen gas. Further off (2 hours' distance) is the gaseous chalybeate Clarisse-quelle, containing 0·055 per mille bicarbonate of iron.

Erdöbenye (Hungary), situated at an altitude of about 780 feet, in a well-wooded valley, 3 miles from the railway station of Liszka-Tolesva, has waters containing sulphate of iron, alum, and arsenic.

AUTEUIL, in France, a suburb of Paris, possesses a cold chalybeate spring, containing 0·71 per mille of sulphate of iron and aluminium, and 2 per mille of the sulphates of calcium, magnesium, and sodium, with traces of arsenic. The total mineralisation is 3·2 per mille. **PASSY**, a part of Paris, also contains sulphate of iron springs, though not employed at present; the analysis of two of them shows the presence respectively of 0·045 and 0·41 per mille sulphate of iron.

The sulphate of iron water of **LE MOUDANG** (0·03 per mille) is sometimes made use of at **CADÉAC**, in the Department Hautes-Pyrénées (see Chapter XXV).

RIO (Elba) has a sulphate of iron spring. Other interesting ones are the hot **PISCIARELLI** springs near Pozzuoli, containing both sulphate of iron and alum, mentioned by Pliny, and still used, it is said, by Neapolitans for external application. There are many other sulphate of iron waters in Italy.

The sulphate of iron and arsenical springs of **LEVICO**, **RONCEGNO**, **VALS**, **SREBRENICA**, and **LINDA-PAUSA**, will be described in the next chapter. **RENNES-LES-BAINS**, and **CIVILINA** and **VALDAGNO** near Recoaro, have already been alluded to in the present chapter amongst ordinary (bicarbonate of iron) chalybeate spas. Amongst other sulphate of iron springs there are those of **RONNEBY**, a well-known spa in Sweden; the 'new spring,' containing about 2·5 per mille sulphate of iron and 1·5 sulphate of aluminium, is only used for bathing, whilst the weaker 'old spring' (0·33 per mille sulphate of iron, and 0·38 sulphate of aluminium) is sometimes used internally; sulphurous and ferruginous mud baths are employed, and there are sea-baths to be obtained in the neighbourhood. **SANDEFJORD**, in Norway, described under sulphur spas in Chapter XXV, likewise possesses a sulphate of iron water (1·29 per mille).

CHAPTER XXIV

ARSENICAL WATERS

ARSENIC occurs in appreciable quantities in some mineral waters, so that from their employment one may expect a beneficial action in cases of anæmia and various cachectic conditions, especially malarial cachexia, where ordinary chalybeate waters do not act well. These waters may likewise be of use in some chronic skin affections.

The action of arsenic is associated with that of sulphate of iron in the waters of Roncegno and Levico and various other sulphate of iron waters; with bicarbonate of iron in the waters of Ceresole Reale, Val Sinestra, Vic-sur-Cère, Sylvanès, and Bussang; and with that of muriated alkaline waters at La Bourboule. It may be doubted whether the amount of arsenic in the weaker members of this group can exert any special therapeutic action. The weakly mineralised waters of Mont Dore contain the minute amount of 0·0009 per mille arseniate of sodium; that is, under 1 milligramme in the litre. However, since arsenic in organic combination has been found, according to Armand Gautier ('Bulletin de l'Académie de Médecine,' Paris, December 5, 1899, page 561, and February 5, 1900, page 116), to be, like iodine, in minute quantities a necessary constituent of the thyroid gland (and even of some other parts of the body), the very minute quantities of arsenic contained in mineral waters such as Mont Dore &c. must be admitted to have a possible therapeutic utility.

Besides the waters separately mentioned in this chapter, minute quantities of arseniate of sodium¹ occur in the waters of Royat (0·0045 per mille in the 'Source Saint-Victor'), Saint-Nectaire (the 'Source des Dames' is said to contain as much as 0·005 per mille), Saint-Honoré (arsenic in association with sulphuretted hydrogen, equivalent to about 0·004 per mille arseniate

¹ Or of arsenic in some other chemical combination, but most conveniently expressed, for the sake of comparison, as if it occurred in the form of arseniate of sodium.

of sodium in the 'Source de la Crevasse'), Vichy (0.002 in the 'Source Grande Grille'), Uriage (0.002), Lamalou (0.001 in the 'Source Capus'), and traces of arsenic are found in the waters of Bath, Baden-Baden, Kreuznach, Plombières, Porretta (in Italy), &c.

Court-Saint-Etienne (Belgium, Brabant) possesses a well (altitude about 260 feet), discovered in 1878, said to contain as much as 0.0097 per mille arsenic acid, or 0.0263 per mille of arseniate of sodium, out of a total of only 0.28 per mille solids. The water is used for exportation solely.

La Bourboule (France, Department of Puy-de-Dôme).—La Bourboule is situated in a pleasant Auvergne valley, at an elevation of 2,780 feet above the sea, on both banks of the River Dordogne. The Valley of La Bourboule (from east to west) has a direction at right angles to the Valley of Mont Dore (from south to north). Mont Dore is four miles higher up the stream.

The waters, which have a sort of chicken broth taste, are distinguished from other muriated alkaline waters by the amount of arsenic they contain. The two principal springs may practically be regarded as one, and be called the 'Source Perrière-Choussy.' Their water has a temperature of 118°–130° F. (140° F. before being pumped up), and, according to the analysis made by J. Lefort and Bouis (1878), has a total mineralisation of 6.4 per mille, containing 2.8 per mille of both the chloride and the bicarbonate of sodium and an amount of arsenic equivalent to 0.028 per mille of the arseniate of sodium. The two Sources Fenestre are cold (66° F.) and much more weakly mineralised; they are used for baths to lower the temperature of the other springs. About half a mile from the spa are some new springs, which are cold, and in chemical constitution rather resemble those of Fenestre.

The La Bourboule waters are employed for drinking (a quarter or half of a glass to commence with), for baths and douches, and for pulverisation and inhalation. In the old inhalation chambers the mineral water is allowed to drop from a height into the centre of the room, so that a certain amount of the pulverised water is inhaled at the same time as the vapour. The patients remain for about half an hour seated in the inhalation chambers, dressed in a sort of large bath towel or dressing gown. A foot bath is often prescribed to be taken whilst inhaling. Apparatus for separate inhalation and pulverisation is also much employed.

The waters are used in affections of the respiratory system, and in cases where muriated alkaline waters are indicated, but owing to the amount of arsenic which they are said to contain, a good result may also be expected in many scrofulous and cachectic conditions, chronic malarious troubles, feeble rheumatic and gouty

patients, and chronic skin affections, when arsenic is indicated. They have been found useful, it is said, in some cases of glycosuria and albuminuria, and have also a certain reputation in early stages and quiescent conditions of pulmonary tuberculosis. Prolonged baths are sometimes prescribed in chronic cutaneous diseases.

Thermal eruptions, diarrhoea, or other varieties of 'well-fever' (poussée) may be observed during the treatment, but as similar phenomena occur at other spas their appearance at La Bourboule cannot be regarded as always due to the arsenic in the water. Indeed, from certain experiments made¹ with the Perrière-Choussy water on rabbits it is doubtful whether the arsenic in the water of La Bourboule is capable of producing any of the unpleasant arsenical symptoms which have been attributed to it. The season is from May 25 to September 30.

Mont Dore (France, Department of Puy-de-Dôme).—Mont Dore lies on the Dordogne near its two sources, in a deep valley of the Auvergne Mountains, at an elevation of 3,440 feet above the sea-level. Though not too much shut in, the spa is almost completely sheltered by Mont Dore and the surrounding heights. Many interesting excursions can be made from the spa.

The thermal springs, one of which at least, the Source César, judging from numerous Roman remains, was known to the Romans, yield weakly mineralised waters, having a temperature of 104°–116·6° F. and containing a minute but appreciable amount of arseniate of sodium (about 0·001 per mille) and about 0·02 per mille bicarbonate of iron. Their total mineralisation reaches about 2 per mille, and they differ from each other mainly in the amount of carbonic acid gas they contain. The Source Madeleine (temperature 113° F., the only one ordinarily used for exportation) and the Source Bardon (temperature 116·6° F.) are perhaps the two springs most generally employed internally. According to J. Lefort, the Source Ramond contains as much as 0·05 per mille bicarbonate of iron.

The cold gaseous 'Fontaine Sainte-Marguerite' (temperature 54° F.) is used as a table water.

The thermal waters are used for baths, douches, foot baths, drinking, gargling, pulverisation, and inhalation. In special cases very hot half baths (sometimes even up to 113° F.) are prescribed, the immersion to last for a few minutes only.

The spa guests include many professional people who have to speak in public, or sing, and are suffering from chronic laryngitis,

¹ See Ferreyrolles and Billard, 'Recherches expérimentales sur la tolérance des eaux de la Bourboule,' *Annales de la Société d'Hydrologie Médicale*, Paris, 1906, vol. li. p. 70. For a general consideration of this health resort see A. Sarazin, *La Bourboule, son Climat et ses Eaux Minérales*, Paris, 1906.

bronchitis, or other chronic affections of the respiratory organs. In their case the inhalation treatment is much employed. Patients wear a flannel dress in the inhalation rooms, and are usually carried there and back again in a 'chaise-à-porteurs.' On their way there and their way back they mostly drink some of the thermal water. The inhalation treatment (sometimes combined with pulverisation) is only carried out in the morning, and is usually followed by a rest before the 'déjeuner' (at half-past ten or twelve o'clock). Patients who undergo this treatment in the morning often take a thermal foot bath or some other treatment in the afternoon before dinner.

Mont Dore enjoys a special reputation in the treatment of asthma, and it may be said that more cases are benefited there than at any other place. The success is most frequent in asthma complicated with chronic bronchial catarrh, but not rarely true nervous asthma likewise derives benefit. Relapses, however, are not uncommon. Many of the Mont Dore patients are gouty or rheumatic, and some of them come for functional nervous troubles.

Much of the good result is due to the climate and ordinary thermal treatment. The arsenic is supposed likewise to have some influence, but on this subject there is decidedly still room for doubt, and the spa is described in the present chapter for convenience, on account of one of the best known explanations of its therapeutic action. The thermal establishment, which was formerly not up to the requisite standard, is now one of the finest in France. Gratuitous treatment is provided for poor patients of the neighbourhood. The season is June 15 to September 15.

Levico (Austria, Tyrol) is a village at the entrance of the beautiful Sugana Valley, at an elevation of 1,700 feet above the sea, with a station on the Val Sugana railway, $12\frac{1}{2}$ miles to the east of Trent. It possesses cold sulphate of iron and arsenic waters, used internally for anæmic conditions, malarial cachexia, &c., and externally for catarrhal conditions of the female generative organs, &c. It is in the grottoes of **VETRIOLO**, above Levico, on the southern slope of the Monte Fronte, at an altitude of about 4,900 feet, that the Levico springs are situated. A chalybeate earth obtained from the neighbourhood of the springs can be used for local mud baths.

The strong Levico water contains, according to Barth and Weidel ('Wiener med. Wochenschrift,' 1882, Nos. 13-16), 0.0086 per mille arsenious acid, 1.3 ferric sulphate, 2.5 ferrous sulphate, 0.047 copper sulphate, 0.62 aluminium sulphate, and a small amount of free sulphuric acid. According to the more recent analysis by E. Ludwig and Zeynek ('Wiener klin. Wochenschrift,' 1898, No. 26), it contains 0.006 arsenious acid, 0.07 copper sulphate,

0·3 zinc sulphate, and 0·2 aluminium sulphate, the total sulphate of iron amounting to 4·6 per mille.¹

According to Ludwig and Zeynek the weak Levico water contains 0·37 per mille sulphate of iron, 0·059 bicarbonate of iron, and only a trace of arsenic. For exportation what is called the 'weak Levico water' is mixed with a little of the strong Levico water, and then contains, according to Barth and Weidel, 0·935 per mille ferrous and ferric sulphates, and 0·00095 arsenious acid. It is taken internally, at the commencement of the course, in doses of one or two tablespoonfuls twice or thrice a day, during or after meals. After two or three weeks the exported stronger water is used in similar doses, which may be doubled later on.

The Levico season lasts from April 1 to the end of September. There is a fine Kurhaus at Levico situated at the foot of the mountains on the northern side of the valley, but during the hottest months many prefer the higher establishment and hotels of Vetricolo, which are open from June 1 to the end of September.

Roncegno (Austria, Tyrol), a village 19 miles east of Trent, possesses the strong sulphate of iron and arsenic water of Monte Tesobo. The spa lies in the Val Sugana at an altitude of 1,750 feet, and has modern accommodation for visitors, and a railway station on the new Val Sugana line, 1 hour distant from Trento.

According to Professor Pietro Spica's analysis of 1888 the Monte Tesobo water has a total mineralisation of 7·87 per mille, and contains 0·109 per mille arseniate of sodium, 3·11 per mille sulphate of iron, 0·028 per mille sulphate of copper, 1·38 per mille sulphate of aluminium, 0·21 per mille sulphate of manganese, 0·047 per mille sulphate of nickel, 0·025 per mille sulphate of cobalt, 0·038 per mille phosphate of iron, 0·115 per mille arsenic anhydride (pentoxide), and 0·209 per mille organic matter.

The season lasts from May 1 to the end of September.

Ceresole Reale (Italy, Piedmont) is a small village in the valley of the Oreo, which can be reached in about 5 hours from Turin. It lies at an elevation of 5,290 feet between the Grand Paradis and the Levanna Mountains, both of them over 11,000 feet. The water of the two springs is similar, and contains, according to Sobrero's analysis, 0·17 per mille bicarbonate of iron, 0·0057 per mille arseniate of sodium, and about 0·003 per mille each of bicarbonates of lithium and manganese. The situation is beautiful, the air bracing, and the accommodation good.

¹ A list of writings relating to Levico and its mineral waters is appended to Dr. O. Liernberger's *Die Kuren und das Klima von Levico und Vetricolo* (Vienna, 1903). See also the collection of writings entitled, *Das Arsenbad Levico in seiner therapeutischen Bedeutung*, compiled by Dr. K. Beerwald, of Berlin (Berlin, 1903).

Val Sinestra (Switzerland, Canton Grisons).—The springs of Val Sinestra are about 3 hours distant from Tarasp-Schuls, and the waters may be obtained at Schuls, freshly brought there each day from the spring; they are likewise exported in bottles. They are said to contain about one-fifth of the amount of arsenic held in the strong waters of Levico, and to have the advantage of containing bicarbonate instead of sulphate of iron. According to Husemann's analysis the Ulrichsquelle contains 0·0017 and the Conradinsquelle 0·0019 per mille of arseniate of sodium. Both these springs include amongst their constituents about 0·03 per mille of the bicarbonate of iron and about 1·5 per mille of the bicarbonate of calcium.

Cudowa, in Prussian Silesia (Chapter XXIII).—Arsenic has been found in the Eugenquelle in the form of arseniate of iron. The water of this spring is said to contain 0·07 per mille bicarbonate of iron, 1·29 per mille bicarbonate of sodium, and 0·0025 arseniate of iron.

Linda-Pausa, in the kingdom of Saxony (Saxon Vogtland).—The two small establishments are situated on a kind of table-land, at an altitude of about 1,300 feet. They possess carbonate of iron waters (poor in free CO_2), and arrangements for moor baths. Bad Pausa is close to the railway station of Pausa. Bad Linda is about $1\frac{1}{2}$ miles distant. According to H. Fleck a sulphate of iron water, discovered at Bad Linda in 1887, contains 6·6 per mille sulphate of iron (ferrous and ferric sulphates) and 0·003 per mille arsenious acid.

Srebrenica, or **Srebrenik** (altitude 1,200 feet), in the east of Bosnia. The cold Guberquelle (total solids 0·753 per mille), according to Professor E. Ludwig, contains 0·37 per mille sulphate of iron (ferric sulphate), 0·227 per mille sulphate of aluminium, 0·007 per mille sulphate of zinc, 0·008 per mille free sulphuric acid, 0·006 per mille arsenious acid. The dose for adults to commence with is two tablespoonfuls.

Hermannsbad, near Lausigk, in the kingdom of Saxony. (See Chapter XXIII.)

Civillina and **Valdagno** are mentioned under Recoaro in Chapter XXIII.

Bussang (France, Department of Vosges) is situated in a valley of the Vosges Mountains at an elevation of 2,200 feet above the sea. The railway station is the terminus of a branch line from Epinal. Its weak alkaline waters are moderately rich in carbonic acid gas; the Source Salmade, out of a total of 1·5 per mille solids, contains 0·0086 per mille carbonate of iron, 0·003 per mille carbonate of manganese, and 0·0012 per mille

arseniate of iron. The water is chiefly exported and drunk at meals.

Sylvanès (France, Department of Aveyron) lies in a mountainous district at an altitude of 1,312 feet, and is reached from the railway station of Ceilhes-Roqueredonde. Its thermal waters (88° to 97° F.) out of a total of about 1 per mille solids are said to contain 0·02 carbonate of iron and 0·016 of arseniates (iron and magnesium). Sylvanès, because its waters are chiefly used for baths, is sometimes classed amongst simple thermal spas. Those who take the baths here sometimes drink the cold gaseous alkaline waters (1·8 per mille bicarbonate of sodium) of ANDABRE, 2½ miles distant from Sylvanès and Camarès.

Vals (see Chapter XIX), noted for its cold alkaline springs, possesses also weakly mineralised sulphate of iron springs. The 'Source Saint-Louis,' out of a total of 0·4 per mille solids, contains 0·04 per mille sulphate of iron, partly the protosulphate and partly the persulphate, and 0·001 per mille of arseniates: it likewise contains 0·099 per mille free sulphuric acid. The 'Source Dominique,' the best known of this group, contains 0·003 per mille arseniate of iron.

Vic-sur-Cère (France, Department of Cantal), lying at an altitude about 2,200 feet at the foot of the Cantal Mountains, possesses cold gaseous chalybeate waters, which are said to contain 0·05 per mille bicarbonate of iron, 0·008 per mille arseniate of sodium, 1·8 per mille bicarbonate of sodium, 1·2 per mille of earthy bicarbonates, and 1·2 per mille of common salt. The establishment lies about three-quarters of a mile off the village, but the waters are chiefly used for exportation.

CHAPTER XXV

SULPHUR WATERS

ALTHOUGH it is difficult to explain the action of sulphur waters, and although their special therapeutic value has been altogether called in question, yet experience seems to show that the stronger waters of this group, at all events, indubitably exercise some therapeutic effect. The action of the very weak sulphur waters is probably similar to that of simple thermal or ordinary hydrotherapeutic treatment, aided by climate, diet, healthy mode of life, and general medical guidance. In compound sulphur waters the action is modified by the presence of other constituents in the waters.

Sulphur waters are used for baths, douches, drinking, pulverisation and inhalation. The complaints treated are chronic rheumatoid arthritis and 'rheumatic' affections, chronic catarrhal conditions of the alimentary canal, hyperæmia of the liver and hæmorrhoids, chronic bronchial, laryngeal, nasal, and pharyngeal catarrhs; also constitutional syphilis, chronic metallic poisoning, some scrofulous affections, and chronic skin eruptions.

The action of prolonged sulphur baths in skin affections is probably nearly similar to that of simple thermal baths (see Chapter XVII) or thermal earthy baths. Yet, it must be noted that P. Roethlisberger,¹ experimenting with the sulphur baths of Baden, in Switzerland, has apparently obtained effects on the temperature, circulation, and metabolism of the body differing from those ordinarily produced by simple water at the same temperature.

In some cases the sulphides (or products derived from their decomposition) may exercise a special germicidal action on the skin. Verdenal,² of Eaux Chaudes, found that a culture of pyogenic microbes grew more slowly when sulphur water was added to the culture than when the same quantity of distilled water was added. He suggests that it might be owing to some

¹ *Journal of Balneology and Climatology*, January 1904.

² *Essai d'une Application de la Bactériologie à la Médecine Thermale*, Pau, 1896.

mild antiseptic action that in older times certain sulphur waters obtained a great reputation in the treatment of wounds.¹ Thus the waters of Eaux Bonnes were called 'Eaux des Arquebusades,' after the Béarnese soldiers wounded in the battle of Pavia (1525) had resorted thither to be cured. Other sulphur waters, such as those of Barèges, have likewise enjoyed a great reputation for the healing of wounds, but almost the same healing power has been attributed to simple thermal waters (see Chapter XVII). There can be little doubt that in bygone times both simple thermal waters and thermal sulphur waters owed part of their reputation to the ordinary effects of prolonged bathing in certain parasitic affections of the skin, especially scabies. The '*acarus scabiei*,' the cause of scabies, was probably drowned by the water, but the beneficial results in such cases were doubtless greatly assisted by the germicidal action of the sulphuretted hydrogen in the thermal sulphur waters.

In regard to the therapeutic and bactericidal action of sulphur waters, as of simple thermal and other mineral waters (when fresh from the spring), the possible influence of radio-activity must be borne in mind (see Chapters XIII and XIV).

Treatment by thermal sulphur baths has been esteemed by some authorities at Aachen &c. as of service to bring out signs of latent syphilis, and useful to show if the virus should be regarded as still remaining in the body. The treatment might thus throw light on the nature of obscure pains, glandular enlargements, loss of hair, &c., which could previously not be traced to syphilis with certainty. The test action by sulphur waters was suggested by Güntz to depend on the action of sulphur in aiding the elimination of mercury from the tissues. According to this theory the mercury is stored in the tissues in the form of an albuminate, and prevents the appearance of syphilitic manifestations; the sulphur treatment accelerates the albuminous catabolism, causing therefore the breaking up and excretion of the albuminates of mercury; the removal of the mercury then allows the syphilis to manifest itself again. Though with a positive result this test action of hot sulphur baths may be of considerable utility, no certain negative conclusions can be drawn from a negative result, and the great diagnostic value formerly attached to the latter result has unfortunately been found undeserved.

The real effect of thermal sulphurous and muriated sulphurous waters in aiding the regular treatment of syphilis is due in part to the good effect of the spa-treatment on the nutrition in general, and in part to the direct influence of the baths on the skin functions.

¹ A similar antiseptic action is claimed by Duhourcau, Schlemmer, and J. Felix for the alkaline silicates present in most weakly mineralised thermal waters.

The baths probably promote the elimination from the body of the specific toxins of the disease, and perhaps indirectly increase the antisypilitic action of the mercury in the tissues (see, however, Part III, Chapter XXXII, Section on Syphilis and footnotes).

Strong sulphur waters when used internally seem sometimes to exercise an internal antiseptic action, and it is possible that the beneficial effect of sulphur waters in some cases of chronic furunculosis may be in part explained in this manner.

The aperient action of sulphur waters differs widely in different individuals, as does every effect of all mineral water and indeed most other kinds of treatment, and even in the same individual at different periods. For chronic constipation the simultaneous use of other aperients is often necessary. The effect of strong sulphur waters in some cases of habitual constipation, abdominal plethora, hæmorrhoids &c. may be compared to the well-known use of ordinary pharmaceutical preparations of sulphur in many cases of similar nature.

When sulphur waters are taken internally a greenish coloration is sometimes observed in the fæces, especially when the motions are rather loose. H. Roth,¹ and after him others, supposed that this colour, and the blackish appearance of the fæces likewise sometimes observed, were due to the presence of sulphide of iron. Mainly on this observation Roth founded his theory of the therapeutic action of sulphur waters. He thought that the sulphur combined with the iron in the hæmoglobin of the red blood corpuscles, especially of the effete ones, their destruction being thereby accelerated and the products of their destruction excreted by the liver. In this way he explained the diminution in the size of the liver sometimes noted during treatment with sulphur waters, the improved portal circulation, and the beneficial action in hæmorrhoids, &c.

H. Stiff,² of Weilbach, showed conclusively that the peculiar coloration of the fæces could not be due to any sulphide of iron which they might or might not contain. Supported by certain observations of Lehmann, he came to the conclusion that the greenish coloration, when present, must be due to bile pigments (biliverdin), which must be either secreted by the liver in increased amount or must be hurried through the intestines and thus escape complete conversion into hydrobilirubin. Stiff's explanation is supported by H. Schulz,³ one of the more recent writers on the subject.

¹ H. Roth, *Die Bedeutung des kalten Schwefelwassers zu Bad Weilbach in Unterleibskrankheiten &c.* Wiesbaden, 1854.

² H. Stiff, 'Die Mineralquellen zu Bad Weilbach,' in Grossmann's *Heilquellen des Taunus*, Wiesbaden, 1887, p. 76. Also *Die phys. und ther. Wirkung des Schwefelwasserstoffgases*, Berlin, 1886, pp. 48, 106, and 130.

³ H. Schulz, *Studien über die Pharmakodynamik des Schwefels*, Greifswald, 1896, p. 64.

It seems probable that, at least in many cases of enlarged liver and in well-fed persons, the secretion of bile is, as Stiff and Stern¹ with others think, increased by the use of sulphur waters,² and, as bile pigment is apparently derived from blood pigment, it is most likely that a loss in hæmoglobin, especially from effete red blood corpuscles, does take place, as suggested by Roth, though less in anæmic persons than in those of a plethoric type. In this way also may be explained the tendency (in some persons) of prolonged internal courses of the stronger sulphur waters to induce an anæmic condition, which, however, is usually rapidly recovered from. According to Bain and Edgcombe³ the presence of sulphuretted hydrogen in waters taken internally may cause an actual and considerable fall in the hæmoglobin-value of the red blood corpuscles, and these observers believe that the therapeutic value of the water they experimented with (the 'Old Sulphur Well' at Harrogate) would be enhanced if it contained less sulphuretted hydrogen.

Some observers believe that the chief action of sulphur waters is through the nervous system (vaso-motor), and Stiff thought that by their use, and the inhalation treatment, a special effect is exerted through the branches of the pneumogastric nerve on the throat, bronchi, stomach, liver, &c. Perhaps really the stronger sulphur waters (acting more in some individuals than in others), whilst helping in the destruction of old and imperfect red blood corpuscles, exert by means of the nervous system an alterative effect on the general nutrition, and thus pave the way to a kind of regeneration of the blood and to the more perfect functioning of the liver and other organs. However, in considering the results obtained at sulphur spas the action of ordinary thermal baths, douches and douche-massage, as well as the influence of climate, open-air life, and change of diet, must be kept in mind.

Sulphur waters as a general rule keep badly, and should therefore, if possible, be drunk at the spring itself, in spite of the

¹ B. A. P. Stern, *Bad Weilbach und seine Mineralquellen*, Wiesbaden, 1896, p. 14.

² That the whole question is not a simple one is shown by the investigations of Dr. W. Bain, of Harrogate (*Brit. Med. Journ.* 1898, vol. i. p. 1646; and 1905, vol. ii. p. 269). By his experiments in a man, aged 49, with a permanent cutaneous biliary fistula, he found that the Old Sulphur Spring at Harrogate increased both the quantity of bile and the percentage of bile solids, whereas another strong sulphur spring (the 'Strong Montpellier Spring' at Harrogate) appeared slightly to diminish both. It must also not be forgotten that the secretion of bile is only one, and probably by no means the most important, of the functions of the liver, and it is not certain that hepatic stimulants are necessarily also cholagogues. Bain thinks that some of the effect of the Old Sulphur Spring at Harrogate in cases of cholelithiasis may be due to the barium chloride which it contains.

³ *The Physiology and Therapeutics of the Harrogate Waters*, London, 1905, pp. 25-28.

improved methods of bottling. Polysulphides, if these are present with the monosulphides, are decomposed, some of their sulphur being precipitated, and sulphuretted hydrogen gas being given off. In the waters rich in sodium sulphide a rapid change sometimes takes place on exposure to the air.¹ The carbonic acid in the water and the air combines with the sodium to form carbonate, and a part of the sulphur thus set free constitutes the flocculent precipitate seen at Bagnères-de-Luchon &c., whilst another part combines in the nascent condition with hydrogen from the water, and is disengaged in the form of sulphuretted hydrogen gas (the characteristic smell of which is not noticed in the pure sodium sulphide waters when quite fresh). Another part of the sulphide of sodium undergoes conversion successively into the hyposulphite, sulphite, and sulphate of sodium. It is to chemical changes of this kind that some of the Pyrenean sulphur waters owe their tendency to alter rapidly ('degenerate' or become 'dead') on exposure to the air. They become alkaline owing to the presence of sodium carbonate. Some of the thermal waters of the Eastern Pyrenees are weakly alkaline partially degenerated sulphurous waters, even when fresh from the spring, others are already 'completely degenerated,' and contain no sulphide of any sort, but only a little sulphate and carbonate. Such waters may be practically ranked with the simple thermal group.

Sulphur waters are sometimes divided into several subdivisions, the chief of which are the following three: (1) Sulphide of sodium waters, in which the main sulphurous constituent is sulphide of sodium. Such waters are those of the Pyrenean spas: Cauterets, Bagnères-de-Luchon, Barèges, &c. (2) Sulphuretted hydrogen waters, in which the main sulphurous constituent is sulphuretted hydrogen gas. Such waters are those of Schinznach, Weilbach, Aix-les-Bains, Strathpeffer, Llanwrtyd Wells, &c. (3) Muriated sulphur waters, in which besides sulphuretted hydrogen a certain quantity of common salt is present. Such are the sulphur waters of Aix-la-Chapelle, Uriage, Harrogate (Old Sulphur Well), Llandrindod Wells (sulphuretted spring at the Pump House), Hercules-Bad, Acqui, &c. This order of arrangement has not been adopted here, but we shall first describe Bagnères-de-Luchon, Cauterets, Eaux Bonnes, Aix-la-Chapelle, and Aix-les-Bains, and

¹ H. Bordier and H. Julia de Roig ('De la résistance électrique des eaux thermales de Cauterets,' *Annales d'Hydrologie*, Paris, December 1904, pp. 345-365) show that this transformation of the sulphide is accompanied by a diminution of the electrical resistance of the water, and by means of this test they have been able to demonstrate that in the course of a few months bottled water from the 'La Raillère' spring at Cauterets undergoes a 'degenerative' change which possibly robs it of most of its therapeutic virtue.

shall then proceed with the other sulphurous spas in their political geographical order.

Bagnères-de-Luchon (France, Haute-Garonne).—Luchon (altitude 2,050 feet) is a most beautiful spa situated on the western side of a broad level valley, and sheltered by mountains in almost every direction. The fertile plain in which the spa lies is an expansion of the Valley of Luchon, where it joins the valleys of Arboust and the Pique. Many Roman remains found in the neighbourhood show that Luchon (*Balnearia Lixónensia*) was known to, and its springs used by, the Romans.

The many thermal sulphur springs vary in temperature from 61° to 152° F., and the amount of sulphide of sodium also differs much: that in the Source de la Reine amounts to 0.056 per mille, and that in the Source Bordeu to 0.07 per mille. The waters (e.g. Source Ferras and Source Blanche) become soon altered on exposure to the air, and throw down a precipitate of sulphur. They are used for drinking, for baths and douches and vapour baths, for gargling, in the form of a spray to the throat, for nasal douches, and for inhalation (cf. p. 349) of the vapour (by a special apparatus of A. Frebault). The most important treatment at Luchon is 'external,' but the necessary inhalation of sulphuretted hydrogen makes the external treatment to some extent also internal. The thermal establishment and hydrotherapeutic arrangements are excellent. There is also a small mineral water swimming bath. By employing springs of different strengths and temperatures the action of the baths and douches may be considerably varied. The effects of massage are added, when required.

Behind the thermal establishment is the mountain of Superbagnères, on the slopes of which are many shady walks, and at the base of which are the galleries excavated in the rock, containing the sources of the different sulphur springs. Owing to the heat and moisture arising from the water, the interesting tour of these galleries could be used as a most effective vapour bath.

The affections treated at Luchon include rheumatoid arthritis and the resulting stiffness in joints, chronic catarrhal conditions of the respiratory organs, torpid scrofulous states, chronic cutaneous eruptions, and syphilis. In affections of the respiratory organs inhalation treatment is much employed. In syphilis the ordinary antisyphilitic methods are, as at Aachen &c., aided by the thermal treatment.

The climate of Luchon is warm, but, owing to its mountainous position, is subject to rather sudden changes. The season is from June 15 to October 15, but the thermal establishment is open throughout the year. Owing to the beauty of its scenery, its

amusements and gaiety, and the attractive excursions in the neighbourhood, Luchon is during the season a centre for tourists and ordinary visitors, as well as for patients.

There is a cold chalybeate spring near the Castel Vieil, $1\frac{1}{2}$ miles from the spa.

Cauterets (France, Department of Hautes-Pyrénées).—Cauterets is a little town situated in the narrow winding valley of the Gave¹ de Cauterets, at an elevation of about 3,200 feet above the sea-level. This spa enjoys a great reputation in France, and an old one, for it was visited in the sixteenth century by Queen Marguerite of Navarre, the intellectual sister of Francis I. of France.

Of the many thermal sulphur springs the principal ones have temperatures ranging from 103° to 128° F., and out of a total of about 0.2 per mille solids, have amounts of sulphide of sodium varying from 0.01 to 0.022 per mille. The hotter the springs are (just as at Barèges), the more sulphide they seem as a rule to contain; this fact suggests that at their subterranean origins all these springs may have the same chemical composition, but that in their passage by longer or shorter channels to the surface, and according to the strata through which they have to pass, they lose in temperature and richness of sulphide, possibly sometimes by meeting ordinary pure water before they reach the surface. The principal spring is the 'Source la Raillère' on the banks of the Gave, at a rather bare part of the valley to the south of Cauterets, a good mile distant, and about 400 feet more elevated than the spa. The water (temperature 103° F.) contains 0.015 per mille sulphide of sodium, and has a particular reputation in affections of the respiratory organs. The hottest spring, 'Source des Œufs,' supplies the 'Thermes des Œufs,' which forms one building with the Casino. The springs 'de César' (temperature 118.5° F.) and 'des Espagnols' (temperature 116° F.) are likewise reckoned amongst the chief. It may be noted that as helium has been discovered in Cauterets waters, and as helium is now known to be derived from radium, it is just possible that radio-activity may have something to do with the therapeutic effects of the waters fresh from the thermal springs.

The principal bath establishments are those of La Raillère, des Œufs, the old establishment of César, and the Néothermes; the last of which is supplied by the César and Rocher springs and by a spring of pure water (Ricumiset).

Besides their internal use and their use for baths and douches the Cauterets waters are very much employed for gargling, for

¹ The word 'Gave' in this part of the Pyrenees is applied to any mountain stream, just as the word 'Doron' is used in the Tarentaise near Brides-les-Bains.

inhalation of the finely pulverised spray or vapour, and sometimes for nasal douches. The douche-massage after the manner of Aix-les-Bains (*q.v.*) is employed at Cauterets in suitable cases.

The spring of Petit St. Sauveur, as the name implies, is considered to be analogous to the springs of the neighbouring spa of St. Sauveur, and is employed for its more sedative action in many cases of painful and irregular menstruation in young and in erethic subjects. The 'Source Pause Vieux' (temperature 107·2° F.) is likewise employed in gynæcological cases. The 'Source Mauhourat' (temperature 121° F., containing 0·01 per mille of sulphide of sodium), situated close to La Raillère, is only used for drinking, and has a special reputation in cases of dyspepsia and uric acid gravel.

The principal reputation of Cauterets is, however, undoubtedly for cases of chronic pharyngitis, laryngitis, and bronchitis, including conditions termed clergyman's sore throat, gouty conditions, and the remains of simple catarrhal affections, but not including tuberculous laryngitis, active pulmonary tuberculosis, or chronic bronchitis and emphysema in subjects with decided dilatation or degenerative conditions of the heart.

It cannot be said that Cauterets is well provided with shady and level walks, such as might be desired for many patients. Amongst long excursions for the more robust visitors is the beautiful one up the valley to the Pont d'Espagne (4,880 feet) and further on to the little mountain lake of Gaube (5,710 feet).

The spa life at Cauterets is very characteristic. At an early hour of the morning patients may be seen flocking to La Raillère, which is the spring most employed. All those who can (the majority) make this uphill journey on foot; those who cannot or will not walk can go by the electric railway, or in exceptional cases have the water brought to them at their lodgings. The principal time for taking the waters in the morning is between seven and ten o'clock, a bath or douche is likewise often taken about that time. About eleven o'clock is the time for the French *déjeuner*, the first real meal. Till then those who are strong enough are advised not to break their fast, but in some cases a cup of bouillon, milk, or tea is allowed on rising, or a glass of milk may be taken half an hour after drinking the water, especially by the class of patients for whom Mauhourat water is ordered. The milk may be had fresh from the cows which are kept for this purpose close to the spring. As a rule the doctors advise that the Cauterets waters should not be mixed with milk or syrup, at least when they are taken at the source.

In the afternoon there is a band of music in the town; later on from about four to six o'clock the waters are often drunk

a second time, and, according to the nature of the case, this is often followed by spraying the throat, inhalation of the vapour, &c. About half-past six is the usual time for the dinner or evening meal. After this there are entertainments at the Casino &c. to occupy the rest of the day. The season is from the middle of May to the beginning of October.

Eaux Bonnes (also called **BONNES**) (France, Department of Basses-Pyrénées).—The village (altitude 2,460 feet) stretches from north to south in a rocky offshoot of the picturesque valley of Ossau, 26 miles to the south of Pau.

Of the thermal sulphur springs (temperature 72° – 90.5° F.) the hottest and most important is the 'Source Vieille' (total solids amount to only 0.6 per mille; about 0.02 per mille sulphide of sodium; traces of calcium sulphide and other sulphides; about 0.3 per mille chloride of sodium and other chlorides; flakes of 'barégine'). The waters of Eaux Bonnes keep better than many other sulphur waters, and do not, like the Luchon waters, whiten on exposure to the air.

The waters are used chiefly in chronic bronchitis, granular pharyngitis, and catarrhal affections of the respiratory organs, especially those associated with much expectoration. The supply of waters is not very great, and they are employed chiefly for drinking, sometimes for gargling, inhalation of the spray, or nasal douches, and but little for baths, whereas the waters of Eaux Chaudes (5 miles off) are used principally for bathing and external applications. Although a great number of tuberculous patients come to Eaux Bonnes, there is no danger of infection. The greatest care is taken in regard to sanitary precautions, especially the disinfection of rooms.

The effect of a course of waters is excitant at first, augmenting the secretion from the mucous membranes and the amount of cough. The urine is increased in quantity, the pulse becomes more frequent, and the appetite greater. With this general excitation and exaggeration of symptoms at the commencement of the treatment there may be a feeling of general uneasiness and insomnia, but all this should pass off, and an improvement in the symptoms should take place, or the normal condition should be reached.

Small doses are used at the commencement (half a glass or less), which are gradually increased, but more than three or four glasses are seldom prescribed. Whey, milk, or an ordinary or medicated syrup is sometimes added to the water. The treatment is contra-indicated when there is decided fever or acute inflammation, in neurotic and 'dry' asthma, and in very irritable subjects.

The 'Source Froide' (temperature 53.6°) is used in dyspeptic conditions.

The 'Promenade Horizontale,' though perhaps as yet hardly shady enough, affords a pleasant level walk for those patients who cannot go up hill. The gently rising 'Promenade de l'Impératrice' requires a little more exertion. The Jardin Darralde, in the centre of the spa, where the band plays during the season, and some paths in the surrounding woods, are more shady. Altogether Eaux Bonnes, in the variety and shadiness of its walks, is decidedly richer than its neighbour Eaux Chaudes. Though the general absence of wind is remarkable, warm clothing should be brought, owing to the fluctuations of the temperature in the Pyrenees. Patients sometimes go to the seaside for an 'after-cure,' and indeed at the end of the season in some cases the not-distant Biarritz may be a suitable place to go to. The Eaux Bonnes season is from the beginning of June to the end of September.

On the mountain side, about 2,624 feet above sea-level, a sanatorium for patients with pulmonary tuberculosis has been established by Dr. Portes (1900). The patients' rooms face the south, and the general arrangements are suited to the treatment of pulmonary tuberculosis by the modern methods, viz. fresh air and general hygiene, good feeding, and individual medical supervision.

Aachen (AIX-LA-CHAPELLE) (Germany, Rhenish Prussia).—Aachen (altitude 530 feet) is a very important industrial city in Rhenish Prussia with 96,000 inhabitants, and its size in some respects modifies the character of the place as a spa. In its cathedral are the famous relics of Charles the Great, who has been honoured as the discoverer of the springs and founder of the town, but thermal waters at Aachen (Civitas Aquensis) were certainly known to the Romans, and were visited in A.D. 756 by King Pepin the Short, at which time the town bore the name of Aquisgrani. It was in 1267, when Richard¹ Earl of Cornwall was 'King of the Romans,' that the 'King's bath' came into the possession of the town.

The town is built on sandy soil, and is fairly sheltered by hills; the climate is moderately moist, and the temperature is somewhat higher than that of Berlin in winter and lower in summer. Its surroundings are beautiful. The Lousberg on the north is only a short walk from the town, and on the south-west the cool promenades of the Aachener Wald (the property of the town) can easily and quickly be reached by the electric tram.

¹ Richard likewise presented to the town the special regalia sent over from England for his coronation.

The different springs lie in the middle of the town, including the Kaiserquelle (strongest; temperature 131° F.); Quirinusquelle, Rosenquelle, Corneliusquelle, and others. The waters of the various springs are all of them muriated sulphurous, containing about 2·6 to 2·8 per mille common salt, and about 0·6 per mille carbonate of sodium; they differ from each other, however, in temperature (113°–133° F.), and in the amount of sulphur (sulphide of sodium and sulphuretted hydrogen) which they contain.

The Elisenbrunnen derives its water from the Kaiserquelle, and is the one most used for drinking. The water of the Kaiserquelle, &c., artificially freed of sulphur, and impregnated with carbonic acid gas, is sold in bottles as an agreeable aerated table water. At the bath establishments there are arrangements for vapour baths, and various hydrotherapeutic processes, especially the combined douche and massage. In the town there is likewise a 'Zander Institution,' furnished with Dr. Zander's medico-mechanical appliances for active and passive movements, &c.

On account of the chloride of sodium they contain, the waters are taken in catarrhal conditions of the stomach and alimentary canal, and of the bronchi; there are inhalation chambers for bronchial and laryngeal affections. Chronic rheumatoid arthritis, chronic rheumatic and gouty affections, and the resulting stiffness of joints, are much treated by hot douches, massage, &c. A combination of douche and massage is employed at Aachen similar to the 'Aix douche-massage' at Aix-les-Bains (*q.v.*), but the treatment at Aachen is carried out by a single attendant at a time in most cases.

Chronic skin diseases, such as eczema and psoriasis, are treated at Aachen with some success, the results obtained being in some cases partly due to medicaments, such as chrysophanic acid, &c., applied at the same time.

It is, however, in the treatment of syphilis that Aachen has become most noted. Seventy per cent. of the patients visiting the spa are syphilitics. By careful and methodical anti-syphilitic medication (chiefly mercurial inunction) the doctors at Aachen have gradually secured this great reputation for their spa. The thermal treatment (hot baths, &c.), by favouring the action of the skin and general metabolism, constitutes a powerful aid to the specific methods adopted (see Section on Syphilis in Part III). Aachen is open all the year round; there is a summer season, from April 15 to October 15, and a winter season, from November to April. The patients can live in hotels or in the bath-houses themselves, the latter being very convenient during bad weather.

BURTSCHIED (French, BORCETTE) adjoins Aachen on the south-east. The springs are similar, but somewhat poorer in sulphur, and remarkable for their extreme heat and abundance. The temperature of the 'Kochbrunnen' is about 162° F., and there is another spring, whose temperature reaches 167° F.

Aix-les-Bains, or Aix in Savoy (France).—This famous spa, the 'Aquæ Gratianæ,' or 'Aquæ Domitianæ,' or 'Aquæ Allobrogum' of the Romans, is situated at an altitude of 860 feet, in the beautiful country of the Savoy Alps, to the east of the picturesque Lake of Bourget.

The two chief springs, the 'sulphur spring' and the 'alum spring' (the latter, however, contains no alum), are poor in mineral constituents, but have a temperature of 109·5° to 112° F. and are very abundant; they are fairly rich in glairine and organic matter, and contain sufficient sulphuretted hydrogen to give them the characteristic smell. The waters of these two springs are chiefly used for external application (douche-massage, Berthollet local vapour baths, &c.), though they can also be taken internally.

For internal use, however, the stronger cold sulphur water of Challes (*q.v.*), containing minute quantities of the iodide and bromide of sodium, is sometimes used at Aix, but less than formerly. Challes is near Chambéry, and its water is brought to Aix in large vessels, and can be obtained at chemists in the town. At MARLIOZ, about ten minutes' walk to the south of Aix, is another cold sulphur spring, which is chiefly employed in chronic laryngeal and bronchial catarrhs in adults, and in tendency to bronchitis in delicate children. The inhalation and spray rooms at Marlioz have recently been renewed. The neighbouring feebly mineralised waters of SAINT-SIMON (subthermal) and MASSONNAT have likewise been employed for internal use, but are now almost superseded by the cold weakly mineralised 'SOURCE DES DEUX REINES.'¹ The action of these three waters is probably somewhat analogous to that of the Evian springs (see Chapter XXVII) in gouty conditions, and may doubtless assist the well-known external methods of treatment at Aix.

The various methods of treatment employed at Aix-les-Bains are of service in cases in which simple thermal waters are of use, for chronic gouty and 'rheumatic' manifestations, rheumatoid arthritis, sciatica and gouty or rheumatic neuritis or neuralgia, muscular rheumatism and conditions grouped together by Gowers under the term 'fibrositis'; neurasthenic conditions in arthritic subjects; chronic cutaneous eruptions; and chronic

¹ On this subject see H. Forestier, 'La cure de lavage interne avec l'eau alcaline légère de la Source des Deux Reines comme adjuvant de la cure externe d'Aix-les-Bains,' *Annales de la Société d'Hydrologie Médicale de Paris*, 1906, vol. li. p. 128.

catarrhal affections of the mucous membranes. For syphilis the principles of treatment are similar to those at Aachen (*q.v.*).

Douches and baths are given by preference early or in the forenoon, and if mineral water is likewise taken internally, it is usually prescribed before or after the bath, or partly before and partly after, or else some time before meals. As drinking the waters at Aix plays a part quite secondary to the external treatment, the daily routine is somewhat different from that at the best known German spas, and there is no early morning promenade, with music, as at these spas.

The large bath establishment is the property of the State, and is one of the most efficient of these institutions existing. Poor people are cared for, as well as the rich. There are separate simple thermal baths, and 'piscines' for several people; thermal and cold douches; 'Berthollet' vapour baths for separate parts of the body; and chambers, known as 'bouillons,' in which the hot mineral water is used to form a vapour bath.

Aix is celebrated for the good results obtained in the stiffness of joints arising from former injuries and from gout and rheumatoid arthritis. The chief kind of treatment employed at Aix is said by Daquin (1808) to have been introduced from Egypt after Bonaparte's Egyptian campaign at the end of the eighteenth century. It has received the name of the 'Aix douche,' or better, 'douche-massage,' and consists in the methodical application by two skilled attendants of massage simultaneously with the douche. It may be used for the whole body (the head of course excluded), or be specially applied to the diseased part: the sort of massage or rubbing, and the strength and temperature of the douche, must naturally be varied according to the individual case, and this treatment may be combined with passive movements of special joints. The 'Aix douche' is sometimes followed or preceded by a vapour bath in the adjoining 'bouillon.' After treatment patients should rest for some time; in many cases they are carried by porters on chairs from their hotels to the bath and back again to bed after the bath. The daily application of the general douche-massage ordinarily lasts about ten minutes. After a few days' treatment an interval of rest, or of days in which a simple thermal bath is taken, is usually prescribed. The total number of applications which constitute a single course in most cases is about eighteen or twenty. The 'douche-massage,' more or less after the method of Aix-les-Bains, has been introduced at several other French spas, and has likewise been adopted with success in other countries, for instance, at Harrogate, Bath, and other places in Great Britain.

There is also an establishment at Aix with arrangements for

the Nauheim treatment (*q.v.*) and for medico-mechanical treatment by means of Zander's appliances.

The Aix season lasts from April to November, but the thermal establishment is open throughout the year. During the main part of the season there is no lack of amusement for patients.

Following the spa treatment an 'after-cure' is advisable, and for this purpose a stay on the neighbouring Mont-Revard (5,360 feet), up which there is now a rack railway from Aix, or in colder weather at the less elevated Les Corbières (2,200 feet), may sometimes be recommended. Another neighbouring locality with limited but fair accommodation is the Col-du-Chat (2,090 feet), on the mountain above the Lake of Bourget, opposite to Aix. The not very distant health resorts of Les Avants, Caux, and Glion are very convenient, being sunny, possessing a dry soil, and moderately bracing air.

Harrogate (England, Yorkshire).—Harrogate, situated on an uneven plateau of Yorkshire, at a mean elevation of 400 feet above sea-level, is perhaps the most flourishing English spa, though probably not quite such a centre of fashion as Bath was in the eighteenth century. The lower town is much more sheltered and less bracing than 'High Harrogate' (altitude up to 500 feet), many of the best houses and hotels of which border a large tract of common ground called the 'Stray.' The top of Harlow Hill, which may practically be included as part of Harrogate, is exactly 600 feet above sea-level. (In regard to climate see Part I.) The earliest known mineral spring at Harrogate is said to be the 'Tewit Well,' and to have been discovered about the year 1591 by Sir William Slingsby, of Knaresborough. The 'Old Sulphur Spring' was probably discovered at the commencement of the seventeenth century.

There are now about eighty different mineral springs at Harrogate, and the active constituents vary greatly, in amount and kind, in the different waters. Most of them are cold muriated waters, containing sulphuretted hydrogen and sulphide of sodium. Of these the 'Old Sulphur Well' (Royal Pump Room) with about 0.07 per mille of the sulphide of sodium and 37 volumes per mille sulphuretted hydrogen, is the one most generally preferred for internal use. It contains likewise 12.7 per mille common salt and 0.09 per mille of chloride of barium; the latter substance (see Chapter XIV), of which the amount is about the same as in the Llangammarch waters, has been supposed to exercise a tonic influence on the blood pressure, preventing the depression which might ordinarily be expected from free action on the bowels. The 'Strong (Sulphur) Montpellier' spring is said to contain about 0.2 per mille sulphide of sodium, no sulphuretted hydrogen,

about 12 per mille sodium chloride, about 1 per mille each of calcium chloride and magnesium chloride, and about 0.04 per mille strontium chloride.

The Starbeck Sulphur Wells, the Bilton Sulphur Spring, and the Harlow Car Sulphur Wells (the latter in pleasant wooded country about $1\frac{1}{2}$ miles west of Harrogate) yield mild sulphur waters containing very little sodium chloride (total solids scarcely exceeding 2 per mille). The so-called 'Magnesia Well' gives a mild muriated sulphurous water, containing about 0.4 per mille of the mixed carbonates of calcium and magnesium.

There are also muriated chalybeate springs; of these the so-called 'Kissingen Well' is said to contain 0.13 per mille of carbonate of iron, about 1 per cent. of common salt, about 1.2 per mille chloride of calcium, and no chloride of barium, whilst the 'Chloride of Iron Well' contains about 0.19 per mille of the chloride of iron, 0.16 per mille of the carbonate of iron, about 2.5 per mille of common salt, and about 0.07 per mille of barium chloride. The 'Tewit Well' and 'John's Well' are weak carbonate of iron springs, almost free from chlorides, but not rich in carbonic acid gas like the best known foreign chalybeate springs are.

The sulphate of iron water from the 'Alum Well' in the 'bog field' is interesting on account of its containing, roughly speaking, about 1 per mille each of ferrous sulphate (protosulphate), ferric sulphate (persulphate), aluminium sulphate, calcium sulphate, and magnesium sulphate. A little marsh gas or carburetted hydrogen occurs in some of the Harrogate springs.

The most important waters for internal use can be obtained at what may be termed the centre of the spa, namely, either at the Royal Pump Room or at the Royal Baths Pump Room, which are quite near each other. Here patients may get the following: The two strong sulphur waters (Old Sulphur Well and Strong Montpellier Well), the Mild Sulphur of the Royal Pump Room and the Mild Montpellier Sulphur, the Magnesia water (before 9 A.M. this water has to be obtained at the Valley Gardens Pump Room), the Kissingen water, and the Chloride of Iron water. The two latter may be obtained in bottles after being artificially 'aërated' with carbonic acid gas. Most of the waters are warmed by the 'therma' apparatus before being taken.

In regard to the action of the different Harrogate waters, and particularly the Old Sulphur water, a number of investigations have been carried out by W. Bain and W. Edgecombe¹ to ascertain the influence on metabolism, &c. The Old Sulphur water is usually taken in doses of 10 to 24 ounces in the early morning, 60 to 40 minutes before break-

¹ Bain and Edgecombe, *The Physiology and Therapeutics of the Harrogate Waters, Baths, and Climate applied to the Treatment of Chronic Disease*, London, 1905.

fast, and generally acts decidedly on the bowels without producing griping. By this daily aperient action most patients feel brighter and more energetic, especially after the third or fourth day, and it is supposed that the absence of depression is due to the barium chloride which the water contains. The sulphuretted hydrogen in the water, however, produces, according to Bain and Edgecombe, a fall in the hæmoglobin value of the red blood cells, and this blood-change appears not to occur when only water is employed which has been previously freed from sulphuretted hydrogen. For anæmic patients, therefore, if the water be prescribed at all, it might be boiled (Dr. G. Oliver) to free it from sulphides before use. Bain and Edgecombe likewise show that the Old Sulphur water causes an increase in the excretion of urea and a diminution in the excretion of uric acid and sulphates. The diminution in the sulphates, and probably in the uric acid also, they attribute to the aperient action of the water on the bowels. In gouty albuminuria they recommend, in addition to the Old Sulphur water or some other aperient water taken in the morning, a dose of the Magnesia water twice daily, as they find the supplementary use of the latter water reduces the absolute amount of albumen in the urine. According to Bain's observations,¹ especially in the case of a patient with a permanent biliary fistula, the stimulating effect of the Old Sulphur water on the liver is most decided; no other drug or mineral water which he experimented with produced such a striking increase in both the quantity of bile and of bile solids; whilst with the water of the Strong Montpellier Well a negative result was obtained.

The iron waters are useful in anæmia, but they have not the advantage of the free carbonic acid gas which the foreign springs of Spa, Schwalbach &c. contain. Pharmaceutical preparations of iron may sometimes be used simultaneously with the waters. The common salt of the waters has a favourable influence in many anæmic and cachectic conditions and in bronchitic patients.

In the Royal Baths, Harrogate is provided with recent and elaborate appliances for baths, douches, needle douches, &c., and there are special attendants for the administration of douche-massage after the methods of Aix-les-Bains and Vichy. These balneotherapeutic processes are much employed in chronic gout and rheumatoid arthritis, and in stiff joints resulting from old injury and non-tuberculous disease, &c. Owing to these facilities Harrogate may perhaps be regarded as the chief English summer resort, just as Bath is the winter resort, for the spa-treatment of muscular rheumatism and the class of cases which Gowers has grouped together under the term 'fibrositis.' There are likewise arrangements for brine baths (with Middlesborough brine), various effervescent baths (in which the effervescence is produced with either carbonic acid gas or oxygen),² peat baths (the peaty earth for which is obtained from neighbouring moors), hot air and vapour baths, 'radiant heat' baths (Greville and Dowsing systems), electrical treatment (including D'Arsonval high frequency current), ordinary massage, &c. Chronic eczema and psoriasis can be treated by warm sulphur baths, and syphilis can be treated at Harrogate after the Aachen methods. What is known as the 'Plombières treatment' for muco-membranous colitis (see p. 389) has been recently (1905) introduced at Harrogate,

¹ See W. Bain, Discussion at the Balneological Society, *Journal of Balneology*, July 1898; also *British Medical Journal*, 1905, vol. ii. p. 271.

² An artificial gaseous iron bath, termed the 'Schwalbach bath,' is sometimes employed; it is a bath made effervescent with carbonic acid gas and containing iron in the form of ferrous carbonate.

but warmed sulphur water or plain warm water is used. For the following details of the procedure adopted at Harrogate we are indebted to the kindness of Dr. George Oliver: (1) The patient lies on the right side and then 3 ounces or so of mild or strong sulphur water (102° F.) are passed into the rectum by the Plombières douche-tube (each patient has his own tube). He is then turned on his back and finally on the left side with slight abdominal compression. Evacuation then takes place. (2) Then the sulphur water (similar quantity and temperature) is again injected, and the rectum and colon are thus effectually washed out. (3) The patient is then placed in a sulphur bath, which is maintained at 98° F., while a hot douche (110° F.) is playing over the abdomen for 15 to 20 minutes.¹ (4) The patient is then packed in warm dry towels in the usual way. The whole procedure takes about 1½ hours.

The Harrogate season is from May to September, but the spa is open also at other times of the year. It may be reached in about 6 hours from London.

Askern Spa (England, Yorkshire).—Askern (altitude about 25 feet), a village with a railway station, 6½ miles north of Doncaster, is situated on a large plain, part of which is an imperfectly drained peat bog. It contains a pump room and baths attached to each of its four springs. The waters are alkaline earthy, containing sulphuretted hydrogen gas, and have a yellowish tinge, probably due to their origin in a peat bog. Their action is diuretic, and for internal use they are mostly taken cold to the amount of about half a pint, two or three times a day. For external use, the waters are artificially warmed. They are employed in some forms of dyspepsia, and in chronic gouty and rheumatic affections.

Amongst other sulphur springs in England we may mention the following: GILSLAND SPA (Cumberland), on the River Irthing, in hilly country, about 20 miles from Carlisle, with pure air, fine woods, and beautiful scenery, possessing likewise chalybeate waters; SHAP WELLS, 3 miles from Shap, in Westmoreland; Nottingham and Radipole, near WEYMOUTH (Dorsetshire); ALDFIELD SPA SPRINGS, near RIPON, in Yorkshire (muriated sulphur waters containing, according to A. Dupré's analysis, about 3 per mille common salt), with a new bath-house; CROFT SPA (Yorkshire), and DINSDALE-ON-TEES or LOW DINSDALE (Durham). The latter two places (3 miles from each other) lie on the River Tees, on the border between the counties of Yorkshire and Durham, not far from Darlington.

Llandrindod Wells (Wales, Radnorshire).—Llandrindod (altitude of the upper portion 700 feet) possesses muriated waters, muriated sulphur waters, and weak chalybeate waters. The bracing air of the neighbourhood contributes much to the good

¹ This 'under-water' or 'submarine' douche is what at Harrogate is called the 'Tivoli' or 'submassive' douche, but the term 'douche Tivoli' is used in a somewhat different sense at Plombières itself (see p. 389). The term 'submassive' looks at first sight as if it were a misprint or 'submarine,' the latter word being in use at French spas.

effect derived at the spa, especially to those 'run down' by town life. Llandrindod, although it possessed a local reputation for a long time,¹ has only recently developed into a flourishing health resort. It lies in the centre of an elevated plateau, somewhat sheltered on the east by Radnor Forest. The soil, like that of the neighbouring spas of Llangammarch, Builth, and Llanwrtyd, is clayey. Of this group of health resorts the upper part of Llandrindod, owing to its open situation and rather bare surrounding country, can doubtless claim the most bracing climate, Llangammarch coming next. The healthiness and good sanitation of Llandrindod are manifested by its low mortality.

The muriated waters of Llandrindod (3·4 to 4·8 per mille common salt, 1 to 1·4 chloride of calcium, 0·04 to 0·7 chloride of magnesium) are slightly laxative, and are useful in atonic cases of dyspepsia, in constipation, in some cases of chronic rheumatism, rheumatoid arthritis, gout, gouty glycosuria, and commencing cirrhosis of the liver. In rheumatic and gouty patients their use is often combined with that of the sulphur waters, and in atonic conditions of the alimentary canal with that of the astringent iron waters.

The muriated sulphur waters are weakly muriated springs, containing apparently 1 to 14 volumes per mille of sulphuretted hydrogen gas. They are useful in some irritable conditions of the alimentary tract, with a tendency to diarrhoea, and in some chronic affections of the bladder, when the more strongly muriated waters have a tendency to increase the irritability. They are likewise employed in various cutaneous affections. The sulphur water can be useful, associated with the iron water, in scrofulous affections.

In 1896 a sulphur spring, lately discovered by Mr. T. Heighway, in the so-called 'Park Spa,' was analysed by Dr. H. Swete and Mr. R. Ross, who found that it was a fairly pure sulphur spring like that of Llanwrtyd, with hardly more than 1 per mille of solid constituents (chiefly common salt), and containing 0·04 per mille calcium sulphide, and about 22 volumes per mille sulphuretted hydrogen gas.

The chalybeate spring in the 'Park Spa' (not the so-called 'chalybeate spring' near the lake, the genuineness of which has been called in question), in spite of the small amount of iron (0·018 per mille of the carbonate) and lack of free carbonic acid gas, is said to be of use in anæmic conditions. The water of this spring contains also about 4 per mille common salt and 1 per

¹ The first printed account of the waters is: *A Treatise on the Three Medicinal Mineral Waters at Llandrindod*, by D. W. Linden, London, 1756. Dr. Linden was a German physician who had already written on several English chalybeate springs, and in 1754 visited Llandrindod for a troublesome skin affection. It has been suggested by some that Llandrindod Wells might be the 'Balnea Silurea' mentioned by Pliny.

mille chloride of calcium. The muriated water is sometimes given simultaneously with it. At Llandrindod the muriated ('saline') water is taken usually about 7 to 8 A.M. before breakfast, sometimes to the sound of music as at Continental spas. The sulphur water is taken in the forenoon or afternoon. The latter is given cold, but the former is often artificially warmed.

There are arrangements also for baths and douches at Llandrindod. The Rock House Hotel has a lower and less bracing situation than the Pump House Hotel, but would be of service to many delicate persons requiring shelter from winds, especially during the earlier and later parts of the year, whilst during the hotter months the more bracing position of the Pump House Hotel is preferable for the majority of visitors.

The season is from May to October. A good locality for an after-cure is Lake Vyrnwy Hotel, about 1,000 feet above sea-level, 6 hours distant from Llandrindod, and 12 miles from the railway station of Llanfyllin.

Builth Wells, in Brecknockshire, has waters similar to but stronger than those of Llandrindod. According to Dr. J. Attfield's analysis (1891), the muriated water of Park Wells contains 12·5 per mille common salt and 3·5 per mille calcium chloride. The muriated water of the Glanne Wells has, as far as we know, not yet been properly analysed. The Glanne Wells and Park Wells are about half a mile from each other, and both about a mile and a half from Builth town. Builth is a pleasantly situated market town (altitude about 400 feet) on the Wye, in a broad sheltered valley. Here visitors can stay, since there is only very limited accommodation at the wells (Park Wells).

Llanwrtyd Wells (Wales, Brecknockshire).—Llanwrtyd Wells, situated at 800 feet above sea-level, has a fairly tonic climate, but is more sheltered and less bracing than Llandrindod, to which it ranks second amongst Welsh spas. It possesses a so-called 'pure' sulphur spring with a total of hardly more than 1 per mille solids (chiefly sodium chloride, Herapath detected the presence of bromide and iodide of calcium), and according to Attfield's analysis containing 36 volumes per mille sulphuretted hydrogen. The flow of this spring is very abundant, quite sufficient to meet all demands and render storage unnecessary. There is likewise a weak chalybeate spring, containing 0·011 carbonate of iron. The muriated water of Builth may likewise be obtained if required. The season lasts from May to September. Owing to the relative mildness of the climate Llanwrtyd may sometimes be resorted to during the winter months. Great improvements have been effected at the Dolecoed Hotel, which lies close to the springs, in the pleasant Dolecoed Park, at the western

and most sheltered part of the town. This spa has a great reputation amongst the colliers from the Rhondda Valley, a point of some interest in regard to the action of mineral waters in chronic disorders of the digestive system and metabolism (cf. remarks under Lisdoonvarna).

Strathpeffer (Scotland, Ross-shire) lies on the slopes at the head of the broad valley of Strathpeffer, amidst woods, meadows, and cultivated fields. The general direction of the valley is from west to east, and the spa is more or less sheltered in every direction except towards the east (that is, in the direction of Dingwall and the Cromarty Firth, about 5 miles distant). The climate is mild and equable, but in this respect it should be noted that different portions of the spa have different elevations above sea-level—from the railway station, 135 feet, to the neighbourhood of the Spa Hotel, about 350 feet. The strongest of the older sulphur wells, now called the Morrison Well in honour of Dr. Thomas Morrison, one of the founders of the spa, is said to contain about 0.02 per mille sulphide of potassium, 0.007 sulphide of sodium, and about 40 volumes per mille of sulphuretted hydrogen. According to Dr. R. F. Fox the recently utilised Lady Cromartie Well is still more sulphurous. The chalybeate 'Saints' Well' is said to contain about 0.035 per mille carbonate of iron, but is not a sparkling water like the best known foreign chalybeates. All the Strathpeffer waters are cold, but they can be obtained artificially heated at the Pump Room.

Patients are chiefly treated here for chronic gouty (gouty sciatica &c.), rheumatic, and dyspeptic troubles, and for chronic cutaneous affections, especially eczema of gouty origin. Asthmatics, says Dr. W. Bruce,¹ unless the patient chooses high and open quarters, are, as a rule, not to be recommended to visit Strathpeffer, whilst the spa has proved to be very suitable for visitors from the tropics or sub-tropical regions, to whom a highly bracing air is apt to be over-stimulating.

Although the internal use of the waters takes the first place at Strathpeffer, various kinds of baths, including sulphur, brine, and peat baths (the latter introduced mainly by the exertion of Dr. R. F. Fox), can, if indicated, be employed, as well as the Aix douche-massage and ordinary hydrotherapeutic treatment. The two usual times of day for drinking the waters are in the morning before breakfast, at about eight o'clock, and a little while before the midday meal. At both these times music is provided as at Continental spas. Strathpeffer is open all the year, but according to Dr. Bruce the best time for a visit is from May to August, or perhaps the first half of September. Real invalids, says Dr. Bruce, should come early to get the best weather and the longest days,

¹ *Scottish Medical and Surgical Journal*, August 1898, p. 159.

and also to avoid the rush of sportsmen and tourists, which sets in as a deluge from the middle of July to the 1st of September.

Moffat (Scotland, Dumfriesshire).—This health resort is a clean and attractive country town, with a sheltered position to the south of the Hartfell Mountains, in the Upper Annandale, at an altitude of about 370 feet above sea-level. The cold sulphur well, about $1\frac{1}{2}$ miles distant, has a total solids of 1·5 per mille (chiefly common salt), and yields 5·3 per mille volumes of sulphuretted hydrogen gas.¹ The chalybeate spring ('Hartfell Spa'), not much employed, is about 4 miles from the town; it belongs to the sulphate of iron group of mineral waters, and contains 0·085 per mille sulphate of iron and 0·09 sulphate of aluminium. Waggonettes run daily at fixed times in the morning to and from the sulphur well, and can be used by those for whom the walk is too fatiguing. The sulphur water is chiefly employed for drinking, but there is a small bath establishment in the town, and there are also facilities for ordinary hydrotherapeutic treatment at the large 'hydropathic' establishment. The subsoil is gravelly, and the hygienic arrangements satisfactory. There are plenty of pleasant walks and interesting excursions to be made in the neighbourhood. Moffat, with its waters and pure air, is useful in chronic gouty and rheumatic affections, convalescence from acute diseases, debilitated conditions from mental overwork and town life, &c.

Lisdoonvarna (Ireland, County Clare).—Lisdoonvarna (altitude about 430 feet), the most popular spa in Ireland, possesses cold sulphur and weak chalybeate springs. The Gowlaun spring contains 5·5 volumes per mille of sulphuretted hydrogen gas. Chronic gouty, rheumatic, and dyspeptic troubles are treated, and some cutaneous affections. Lisdoonvarna is only about 3 miles distant from the coast. The climate is bracing, influenced by Atlantic breezes and by the open situation amidst undulating heathy moorland. The season lasts from June to October. Dr. E. D. Mapother ('Papers on Dermatology,' 1889, p. 91) points out that the benefit derived from a stay at Lisdoonvarna does not seem to be due solely to moderation in diet, for poor people, who are always forced to live moderately, likewise derive benefit from the place (cf. remarks under Llanwrtyd Wells). The bracing climate and the alteration in mode of life doubtless favour the good effects of drinking the sulphur waters. Lisdoonvarna is reached in about 8 hours from Dublin; *via* Limerick to the railway station of Ennistymon; thence drive of about 7 miles to the spa.

Lucan (County Kildare) is pleasantly situated in the valley of the River Liffey, at an altitude of about 100 feet, 8 miles to

¹ *Vide* 'Moffat as a Health Resort, and its Waters,' by David Huskie, in the *Scottish Medical and Surgical Journal*, August 1898, p. 175.

the west of Dublin, and possesses cold sulphuretted hydrogen waters, and satisfactory accommodation. It was a popular spa at the beginning of the present century. *Leixlip Spa*, higher up the Liffey, 2 miles west of Lucan, has weakly mineralised waters, with a faint odour of sulphuretted hydrogen. At one time the Leixlip waters were thought to be chalybeate, and were popular with the people of Dublin. The temperature of the spring was found by Dr. Mapother in 1875 to be 64° F.

Swanlinbar (or Swanlibar), a small village (altitude about 300 feet), in County Cavan, Ireland, possesses cold sulphur springs, which were fashionable in former days.

Ballynahinch (Ireland, County Down), 17 miles by railway from Belfast, possesses sulphur waters, having a good local reputation in Ulster. According to Dr. Andrews the sulphuretted hydrogen gas in the lower well amounts to about 3·5 per mille volumes.¹

Weilbach (Germany, Prussian Province of Hesse-Nassau).—Weilbach is situated at an altitude of 440 feet, between Frankfurt and Wiesbaden, 25 minutes' drive from the railway station of Flörsheim. It possesses two mineral springs, the 'Schwefelquelle' and the 'Natronlithionquelle.' The Schwefelquelle is a cold weakly mineralised spring, containing, according to R. Fresenius, 5·2 parts sulphuretted hydrogen gas in 1,000 parts by volume of water. The water is used for drinking in the case of stout persons with a tendency to hæmorrhoids and enlargement of the liver. It is also used for bathing and inhalation, the latter in catarrh of the respiratory organs. The water of the Natronlithionquelle, according to Fresenius, contains 1·2 per mille chloride of sodium, 1·3 per mille bicarbonate of sodium, 0·009 per mille bicarbonate of lithium; it may therefore be classed amongst the muriated alkaline waters, and is used in gouty conditions, and in some urinary complaints. The season lasts from May 1 to the end of September. A good deal has been written by doctors at Weilbach (e.g. H. Roth, H. Stifft, B. A. P. Stern) to explain the action of sulphurous mineral waters.

Nenndorf (Prussia, Province of Hesse-Nassau).—Bad-Nenndorf (altitude 230 feet) adjoins the village of Gross-Nenndorf and lies at the foot of a wooded northerly slope. Of its cold sulphur springs the 'Trinkquelle' (1 per mille sulphate of calcium, and, according to Bunsen, 0·06 per mille calcium sulphide, and 42 per mille volumes of sulphuretted hydrogen) is richest in sulphur, and is the only one used for drinking purposes.

The Rodenberg brine, containing 6 per cent. of common salt,

¹ See Flinn, *Ireland: Its Health-Resorts and Watering-Places*, second edition, p. 159.

with a trace of sulphuretted hydrogen, is conducted from Solldorf, to be used for bathing purposes at Nenndorf, and may be strengthened, if required, by the addition of 'Mutterlauge.' Sulphurous mud baths ('Schwefel-Moorschlamm-Bäder') are very much employed, and a new establishment has been erected exclusively for them. There are likewise rooms where patients may inhale the gases derived from sprays of the mineral water. According to A. Winckler, however, the inhalation rooms contain very little, if any, actual sulphuretted hydrogen.

Patients come to Nenndorf for chronic rheumatism, gout, cutaneous affections, asthma, and catarrhal conditions of the respiratory organs, &c. Amongst the spa-guests was Jerome Napoleon, when King of Westphalia. There are pleasant shady walks on the slopes above the spa. The chief season is from May 15 to September 30. Nenndorf may be reached from Hanover in about 1 hour by railway.

Meinberg (Germany, in the Principality of Lippe-Detmold), one and a half hours' drive from Detmold, lies at an altitude of 660 feet on the northern border of the Teutoburger Wald. It possesses several mineral springs, amongst which are a cold earthy sulphur spring (23 volumes per mille sulphuretted hydrogen), used for baths, and a cold muriated spring with about 5.5 per mille common salt, which can be used internally. A stream of carbonic acid gas which escapes from the soil is used for gas baths (see Chapter XIV). Probably, however, the most important treatment at Meinberg consists in its sulphurous mud baths (Chapter XIV). The season lasts from May 20 to September 10. Chronic rheumatism and gout, sciatica and analogous forms of neuritis or neuralgia, and chronic gynaecological affections are treated at Meinberg. There are pleasant and interesting excursions to be made in the neighbouring parts of the Teutoburger Wald. Meinberg now has a station (Horn-Meinberg) on the railway between Detmold and Altenbeken.

Eilsen (Germany, Principality of Schaumburg-Lippe) is a quiet little spa in a pleasant valley (altitude 230 feet) tolerably protected from the north and east winds. Of its various cold sulphur springs, the Julianenbrunnen contains, according to R. Fresenius (1890), the greatest amount of solid constituents, 2 per mille sulphate of calcium, with about 34 volumes per mille sulphuretted hydrogen. The waters are chiefly used externally. Sulphur mud baths ('Schwefel-Moorschlamm-Bäder') are much employed. There is likewise a room where the sulphuretted hydrogen &c. derived from sprays of the mineral water may be inhaled. Chronic rheumatic and gouty troubles, sciatica and

neuritis, and chronic cutaneous eruptions constitute the chief affections treated at Eilsen. The spa was founded in the last century by Princess Juliane of Schaumburg-Lippe, who derived the idea of the mud baths from Saint-Amand (*q.v.*). There are delightful and shady walks on the Harri and other hills around Eilsen. The nearest railway station (about 1 hour's drive) is Bückeburg, on the Hanover and Minden line. The season is May 30 to September 5.

Bentheim (altitude 300 feet), in Hanover, is situated in a forest of oaks near the Dutch border. It possesses a cold earthy spring (1.3 per mille sulphate of calcium), containing sulphuretted hydrogen, and used for warm baths in chronic rheumatic affections, &c., often in connection with ordinary hydrotherapeutic methods or massage.

Langensalza, in Thuringia (Prussian Province of Saxony), at an altitude of 660 feet, possesses several cold sulphur springs, of which the strongest contains as much as 47 per mille volumes of sulphuretted hydrogen. The establishment is 20 minutes' drive from the railway station.

Wipfeld (Bavaria).—Close by is the LUDWIGSBAD, in a protected position, 715 feet above sea-level. The 'Ludwigsquelle,' a cold earthy sulphur spring (1 per mille sulphate of calcium, 25 per mille volumes sulphuretted hydrogen), is used for drinking and in the preparation of sulphurous mud baths ('Schwefel-Moorschlamm-Bäder'). There are likewise a weak earthy spring, and two weak chalybeate ones.

Kainzenbad, or **Kanitzerbad**, a summer resort in the Bavarian Alps, close to the Tyrolese border, lies at an altitude of 2,460 feet, half an hour distant from the railway station of Garmisch-Partenkirchen. Besides the 'Gutiquelle,' a cold sulphuretted hydrogen spring, there are weak alkaline springs and a chalybeate water. Milk and whey cures, hydrotherapy, and moor baths can be employed.

Abbach (altitude 1,140 feet), in Bavaria, about half an hour's journey by railway from Regensburg, possesses a weakly mineralised alkaline earthy spring, containing sulphuretted hydrogen, which was known as far back as the fourteenth century.

Langenbrücken (Germany, in the Grand Duchy of Baden), at an elevation of about 440 feet, is a station on the railway between Heidelberg and Karlsruhe. It possesses weak cold sulphated sulphur springs, and facilities for inhalation treatment in chronic catarrhal conditions of the respiratory passages.

Bad Boll (Württemberg) is prettily situated in the Filsthal, at an altitude of 1,340 feet, about $4\frac{1}{2}$ miles to the south of the

railway station of Goeppingen. Its sulphuretted hydrogen water was already known in the sixteenth century.¹

Other German cold sulphur waters are those of SEBASTIANSWEILER (altitude 1,570 feet), and the ancient town of REUTLINGEN (altitude 1,110 feet), in Würtemberg; HECHINGEN (altitude 1,540 feet), and TENNSTEDT (altitude 700 feet), in Prussia; BAD HÖHENSTADT (altitude 1,120 feet), near Passau, in Lower Bavaria; WILDBAD-WEMDING (altitude 1,230 feet), near the little town of Wemding and 8½ miles from Nördlingen, in Bavaria. LANDECK, in Prussian Silesia, has been placed in the simple thermal group (Chapter XVII).

Baden-in-Austria.—Baden, near Vienna (altitude 700 feet), pleasantly situated at the entrance of the Helenenthal, is very much frequented as a summer resort by the Viennese. The thermal earthy sulphur waters, known already to the Romans, have a temperature of 80·6° to 96° F., and are used more for baths than for drinking. According to Schneider (1830), the Ursprungsquelle contains about 0·02 per mille sulphide of calcium. There are large thermal baths for several persons, separate thermal baths, mud baths (local and general), and arrangements for hydrotherapeutic processes. There are likewise swimming baths, supplied with the mineral water. Chronic gouty affections, rheumatoid arthritis, 'muscular rheumatism,' scrofula, and chronic skin eruptions are amongst the conditions treated here. When used internally (as in some cases of chronic bronchial and gastric catarrh), the water is mixed with milk or whey, or with the mineral water of another place. The chief season lasts from May 15 to October 15, but the baths are open during the whole year.

Altenburg (or Deutsch-Altenburg), in Lower Austria, near Pressburg, contains a weak thermal sulphur spring, having a local reputation in cases of chronic cutaneous eruptions, &c. This place (altitude 490 feet) was formerly called Hofbad, and was famous. It represents the Roman 'Thermæ Pannoniæ.'

Innichen (Austria, Tirol).—The establishment, 'Wildbad Innichen,' is beautifully placed amidst forests at an altitude of 4,370 feet in a branch of the Pusterthal, three-quarters of an hour from the railway station of Innichen. There are two cold sulphur springs and a chalybeate one.

Alt-Prags (Austria, Tirol), beautifully situated at an altitude of 4,500 feet in the Pragerthal, a branch of the Pusterthal, is

¹ There is also a Bad Boll (3,200 feet) near Bonndorf, in the Baden Black Forest, visited in summer for its climate and fishing.

1½ hours distant from the railway station of Niederdorf. It is a summer resort and possesses a weak sulphur spring used for bathing.

Längenfeld (Austria, Tirol) is situated at an altitude of 3,820 feet, in about the middle of the Oetzthal, a picturesque valley branching out southwards from the Upper Inn Valley. It possesses cold sulphuretted hydrogen waters.

Ladis (Austria, Tirol) is picturesquely situated (altitude 3,900 feet) near the ruined castle of Ladis, on a height above the left side of the Upper Inn Valley, 2½ hours distant from the railway station of Landeck. It possesses cold sulphuretted hydrogen waters. **Obladis**, a summer health resort, situated amid woods about 650 feet above Ladis, at the foot of the Schönljöchl Mountain, has cold sulphur waters used for baths, and a cold gaseous alkaline earthy spring used internally.

Hercules-Bad (Hercules-Fürdo), near MEHADIA, in Hungary (altitude 570 feet), lies in the romantic Czörna Valley, on the railway between Orsova and Temesvar, not far from the Iron Gates of the Danube and the frontiers of Roumania and Servia. Its thermal springs (Roman 'Thermæ Herculis'), with temperatures from 70° to 133° F., are mostly muriated sulphurous ones, containing 1 to 4 per mille common salt, and about half as much chloride of calcium; they have been compared to those of Aix-la-Chapelle, and like them are employed internally and externally, but chiefly externally. The sulphur is contained in the form of sulphuretted hydrogen, one spring having about 22 per mille volumes; but the 'Hercules spring' is quite free from it, and has therefore been already mentioned in the chapter on muriated waters. The same affections are treated as at Aix-la-Chapelle. The situation at the foot of the Carpathian Mountains is very beautiful and much appreciated by the people of South-eastern Europe. The accommodation is good.

Szobrancz (425 feet), in the Hungarian Comitatus Ung, possesses cold muriated sulphur waters and facilities for mud baths.

Pystjan, or **Pistyan**, or **Pöstyén**, in Hungary, lies on the Waag at an altitude of 490 feet, fairly sheltered from the north and east by the Carpathians. The spa, which adjoins the town, is in a beautiful Kur-Park, and possesses very hot thermal sulphur waters (135°–146° F.). The treatment is chiefly external. Hot sulphurous mud baths, both general and local, are much employed, for which abundance of a fine mud, described as 'butter-like,' is obtained from about the thermal springs. Rheumatoid arthritis, the results of injuries to bones and joints, sciatica and analogous 'neuralgias,' and syphilis, are amongst the affections treated. Pystjan has a railway station on the Waagthal line.

Trencsin-Teplitz, or **Trentschin-Teplitz**, is one of the best known spas of Hungary. It lies at an altitude of 850 feet, beautifully situated in a side valley of the Waag, at the foot of the Carpathian Mountains, 6 miles distant from the railway station of Trentschin. Its thermal sulphur waters (99°–104° F.) have a total of about 2·5 per mille solid constituents, chiefly gypsum. The baths and sulphur mud baths can be used in chronic rheumatic affections, rheumatoid arthritis, sciatica and analogous 'neuralgias,' syphilis, &c. The season lasts from the beginning of May to the end of September.

Buda-Pest (see Chapter XVII) possesses thermal sulphur waters and excellent bathing arrangements.

Harkany, in Hungary, lies in a pleasant neighbourhood in the Comitatus Baranya, at an elevation of about 300 feet above sea-level. Its thermal sulphur waters (143°–145° F.) contain under 1 per mille solids. In 1867 in these waters Karl von Than discovered the inflammable gas, carbonyl sulphide (COS), which is said to be present over the spring in a quantity sufficient to be ignited.

Parad, in Hungary, contains the gaseous alkaline sulphurous Csevicze spring. The spa has already been noticed amongst sulphate of iron waters. (See Chapter XXIII.)

Warasdin-Teplitz, or **Warasdin-Toplicza**, in Croatia, 3 hours from the railway station of Csakathurn, lies at an altitude of 900 feet in a pleasant position sheltered from the north. Its thermal sulphur waters (temperature 136·4° F.) are said to have been known to the Romans as the 'Thermæ Jasæ.'

Ilidze (Bosnia) is beautifully situated at an altitude of about 1,600 feet, 8 miles from Sarajevo, the chief town of Bosnia. Its thermal earthy sulphurous waters (temperature 124° F.) contain 1 per mille bicarbonate of calcium, 0·8 sulphate of sodium and 0·039 by weight sulphuretted hydrogen; they have an old reputation for rheumatoid arthritis, &c.

Baden-in-Switzerland (Canton Aargau).—The spa (altitude about 1,230 feet), and the somewhat higher situated old-fashioned town of Baden, lie in a pleasant valley on the banks of the River Limmat. The position of the place is a fairly sheltered one, the climate is mild, and is influenced by the extensive surrounding forests. Its thermal weak sulphurous waters were known to the Romans and employed by their soldiers, and were famous in the Middle Ages; in 1416 the Papal Secretary, Poggio Bracciolini, in a letter to his friend Nicolo Nicoli, described the gay nature of the spa-life. The place was formerly known as Ober-Baden to distinguish it from Nieder-Baden (Baden-Baden).

The average temperature of the waters is 118·4° F.; they smell of sulphuretted hydrogen, and contain a certain amount of

the sulphates and chlorides of calcium and sodium (total solids, according to Müller, 4 per mille). Wagner detected a minute amount of arsenic in the Baden springs, and F. P. Treadwell in his recent analysis draws special attention to the presence of boric acid (borates). Owing to the earthy constituents the water of Baden is not much taken internally, but when this is advisable it may be mixed, as in some hæmorrhoidal cases, when a laxative effect is required, with the neighbouring Birmenstorf bitter water, or in other cases a little bicarbonate of sodium may be added.

The different hotels have their own baths, but there is likewise a separate establishment, which is used by certified poor patients of different countries. The cases treated at Baden include rheumatoid arthritis and articular troubles of a chronic rheumatic or gouty nature, as well as stiff joints resulting from injury, or previous peripheral neuritis. Others are treated for sciatica, lumbago, 'muscular rheumatism,' and various affections on a gouty basis. The baths are usually given at a temperature of about 93° F., and the time preferred is before breakfast. When a more stimulating effect is desired, salt from the neighbouring Rheinfelden brine can be added. Massage is much employed for the joint affections, and for chronic sciatica and muscular rheumatism. Inhalation rooms are provided for use in chronic catarrhal affections of the air passages.

The neighbourhood affords excellent ground for a 'Terrain-Cur' after Oertel's views. The season at Baden is from the middle of May to the end of September, but the spa remains open all the year. Owing to the waters being little drunk, there is no 'Cur-Musik' in the early morning before breakfast, and in this respect the ordinary daily routine differs somewhat from that at most of the well-known German spas.

Schinnach (Switzerland, Canton Aargau).—Schinnach, a station on the railway from Zürich to Aargau, lies at an altitude of about 1,140 feet, in the pleasant valley of the Aar. The establishment is situated in grounds of its own, distinct from the village, and has been likewise known as the 'Habsburger Bad,' from the ruins of Habsburg, which crown the neighbouring Wülpsberg (1,680 feet).

The Schinnach spring yields a thermal strong sulphurous water, the temperature of which varies from 82·4° to 95° F.; according to Grandeau, it contains as much as 37 per mille volumes of sulphuretted hydrogen, with a moderate amount of gypsum (1 per mille) like many other Swiss sulphur waters, and 0·008 per mille sulphide of calcium. The thermal establishment affords good lodging, as well as baths for the patients; it is fitted up for the mineral water baths, vapour baths, and ordinary baths;

also with apparatus for nasal and local douches, and for inhalation of the pulverised mineral water, and the gases given off.

Baths of long duration ($1\frac{1}{2}$ to 2 hours) are often prescribed, and the water has sometimes to be heated one or two degrees for bathing. The mineral waters of Schinznach are used both externally and internally. If taken internally it is recommended that as a rule the dose be taken before the bath.

The affections treated here are chronic eczema and other chronic skin eruptions (for which the spa has a special reputation), chronic gouty and rheumatic complaints, leucorrhoea, chronic catarrhal conditions of the respiratory organs, caries of bone, scrofula, rickets, and syphilis. Nasal douches, sprays, and inhalations are employed in naso-pharyngeal catarrh, bronchitis, asthma, and emphysema. In some scrofulous and cutaneous affections the muriated water of the neighbouring Wildeggen (Chapter XVIII), containing small quantities of iodides and bromides, is recommended for internal use. The season lasts from May 15 to the end of September.

Lavey (Switzerland, Canton of Vaud), $1\frac{1}{4}$ miles from the railway station of Saint Maurice, possesses weak thermal sulphur waters (temperature 92° to 118°), containing, according to Baup, 3.5 per mille volumes sulphuretted hydrogen gas, and 1.3 per mille solids (chiefly sulphate and chloride of sodium). The waters are used for drinking, bathing, and pulverisation. For baths the 'eau-mère' of Bex (*q.v.*) may be added to the thermal water. The 'eau-mère' is sometimes also employed internally, after filtration and suitable dilution with the thermal sulphur water. For aperient purposes a preparation, deprived of most of its chlorides, is used, and other special preparations of the 'eau-mère' are made. Baths of a fine sand from the banks of the Rhone are employed, mostly in the form of local applications, at temperatures of 113° to 130° F. and even higher. There are likewise facilities for massage in hot baths, and for Aix douche-massage, hydrotherapy, and 'wave baths' in the river, which during the heat of summer is full, cold, and covered with foaming waves. Lavey lies in the Rhone Valley at an elevation of 1,350 feet, between the right bank of the river and the rocky base of the Dent-de-Morcles, which shelters it to the east and north. The establishment, hotel, and a small hospital for poor patients stand by themselves away from any village or factory. The affections treated at Lavey comprise scrofula and rickets in children, chronic rheumatism in adults, chronic cutaneous affections, &c.

Yverdon (Switzerland, Canton Vaud) is situated (altitude 1,430 feet) to the east of the Jura Mountains, at the southern

extremity of the Lake of Neuchâtel, on the railway between Lausanne and Neuchâtel. Its sulphur water (temperature 75° F.) is feebly mineralised (according to Bischoff the total of solids is 0·4 per mille), and contains 3·4 per mille volumes of sulphuretted hydrogen and some organic matter. The thermal establishment, ten minutes' walk from the town, was improved in 1905, and contains arrangements for pulverisation and inhalation treatment, and for douches, massage, Aix douche-massage, &c. There are likewise arrangements for artificial gaseous baths, hot vapour baths, 'fango' mud baths, and sun-baths. The affections treated at Yverdon include sciatica, gouty neuritis, and chronic rheumatic affections, chronic catarrh of the respiratory passages and some chronic inflammatory conditions of the female pelvic organs. The season is from May to October. There is good hotel accommodation. In the Jura Mountains, about 16 miles by railway to the north-west of Yverdon, are the summer resorts of Sainte-Croix and Les Basses, between 3,600 and 3,900 feet above sea-level (see Part I).

Lenk (an der Lenk) (Switzerland, Canton Bern), is situated on flat ground near the northern end of the Upper Simmenthal. By misprints in the word it has sometimes been confused with Leuk (see Loèche-les-Bains), in Canton Valais. The establishment (3,630 feet) is about $\frac{1}{2}$ mile from the village, in a slightly more elevated and sheltered position, on the western side of the valley at the base of the Hohliebe; it commands a magnificent view of the rocky ridges and glaciers of the Wildstrubel Mountain, which shuts in the valley to the south.

Lenk possesses two cold gypsum sulphur springs, the Hohliebquelle, the one first known, and the much stronger Balmsquelle, which is said to be the strongest sulphur spring in Switzerland. The latter arises at some distance above the establishment, to which its waters are conducted in pipes; according to the analysis (1876) of Müller and Schwarzenbach, it contains 44½ per mille volumes of sulphuretted hydrogen gas, and 1·6 parts per mille gypsum. A weak, cold, non-gaseous gypsum chalybeate spring (0·01 per mille bicarbonate of iron) is sometimes employed at meal times.

According to De la Harpe the mean temperature for the four summer months is 59·5° F., and there is not as great a difference between the evening and day temperatures as at many other Swiss localities of the same altitude; the greater warmth of Lenk is partly attributed to the stillness of the atmosphere and the radiation from the surrounding mountains heated during the daytime. The adjacent pine forest affords the protection often needed from the midday sun.

Chronic catarrhal conditions of the throat and respiratory organs are amongst the affections most frequently seen at Lenk. The sulphur water is usually warmed for drinking and inhalation, and pulverisation treatment is much employed. Baths of the warmed sulphur waters are used in skin affections, amongst which Dr. Jonquière specially mentions eczema and furunculosis. The season is from June 15 to September 30. Owing to its position and altitude Lenk is suitable in many cases as a simple climatic station, and for an 'after-cure' to courses of mineral waters at other spas. The railway station of Thun is about 8 hours (34 miles) distant by diligence.

Gurnigel (Switzerland, Canton Bern).—Bad-Gurnigel, about 3,780 feet above sea-level, lies high up on the northern slope of the Gurnigel Mountain, adjoining an immense forest of pine trees, and commanding an extensive view towards the Jura Mountains on the north. Its cold strong sulphur spring, 'Schwarzbruennli,' contains, according to De Fellenberg, 1·3 per mille sulphate of calcium, 0·004 per mille sulphide of calcium, and 0·001 per mille sulphide of magnesium, with 35 per mille volumes of sulphuretted hydrogen gas (39 volumes according to Müller). The 'Stockquelle' water, employed therapeutically since the sixteenth century, contains less sulphuretted hydrogen.

The climate is sunny, and, owing to the open position, bracing; there are numberless beautiful walks with protection from sun and wind in the adjacent pine forest, and the accommodation is excellent. The establishment lies by itself, and there are no villages or factories in the neighbourhood to affect the purity of the air and make it dusty.

Gurnigel, according to Verdat's statistics, has a special reputation in cases of dyspepsia and chronic catarrhal conditions of the stomach and digestive organs. The season is from June to September. The railway station of Bern is 5 hours distant by diligence.

Schwefelberg, 2½ hours distant from Gurnigel, has similar gypsum sulphur waters, but lies at a somewhat higher altitude (4,570 feet).

Heustrich (Switzerland, Canton of Bern).—The establishment (altitude 2,300 feet) lies on the left bank of the Kander, at the eastern foot of the Niesen Mountain; it is quite apart from villages and factories, and towards the south commands a view of the Blümlisalp with its dazzling covering of glacier and snow.

The cold sulphur waters contain, according to Müller's analysis, 0·3 per mille sulphide of sodium, and 11 per mille volumes of sulphuretted hydrogen, in association with small quantities of

the bicarbonate (0·6 per mille) and sulphate of sodium. They differ from the neighbouring waters of Gurnigel in their smaller total of solid constituents (just under 1 per mille), and in not containing any sulphate of calcium. Those of the patients who are strong enough to walk to the source, which is about $\frac{1}{4}$ hour distant above the establishment, drink the water where it arises ; it is, however, always to be obtained in bottles at the establishment.

The somewhat high mean relative humidity of the atmosphere is an advantage in irritable affections of the larynx and respiratory passages, for which treatment by pulverisation of the mineral water is provided. There is a compressed air chamber, which can be used in emphysema and chronic bronchitis, when the heart and circulatory system are tolerably sound. Next to the chronic catarrhal affections of the respiratory organs come the cases of catarrhal dyspepsia treated at Heustrich, and amongst cutaneous diseases Neukomm draws special attention to the use of the baths in some cases of furunculosis. Treatment by hydrotherapy, massage, and milk cures can be employed in suitable cases. The season is from the commencement of June to the end of September. Heustrich is 2 hours by carriage from the railway station of Thun, and 40 minutes by omnibus from Spiez, a steamboat and railway station on the Lake of Thun, between Thun and Interlaken. The hotel forms part of the establishment.

Schimberg (altitude 4,670 feet), in the Canton of Lucerne, possesses similar waters to those of Heustrich, but containing rather less sulphur. The establishment, which is visited by patients with chronic affections of the respiratory organs &c., is situated on the western slope of the Schimberg Mountain, by which it is protected from north-east winds, though the south-west and south winds are sometimes violent. For baths the water of another spring (which is termed *chalybeate*) is employed.

Lostorf (Switzerland, Canton Solothurn) lies at an elevation of 1,640 feet, on the southern declivity of the Jura, $1\frac{1}{4}$ hours by carriage from the railway station of Olten. It possesses a cold muriated sulphur spring, which, according to Bolley, contains sulphide of potassium, sulphuretted hydrogen, and 3 per mille common salt. There is likewise another spring, similar but weaker, and a gypsum water resembling that of Weissenburg but colder.

Alveneu, or Alvaneu (Switzerland, Grisons), lies at an elevation of 3,150 feet above the sea-level, in the Albula Valley, not far from Tiefenkasten. It possesses a cold gypsum sulphur spring, containing, according to Planta-Reichenau (1864), about

1 per mille sulphate of calcium and very little sulphuretted hydrogen. Warm sulphur baths, douches, massage and ordinary hydrotherapeutic methods are employed in chronic rheumatic and gouty affections, &c.¹ In the neighbourhood are the sulphated alkaline chalybeate springs of St. Peter at TIEFENKASTEN, or TIEFENKASTELL (according to Planta, 2·2 per mille sulphate of sodium, 1·7 per mille bicarbonate of calcium, and 0·029 per mille bicarbonate of iron), and of St. Donatus at SOLIS; the latter contains a small amount of iodide (0·001) and bromide (0·002) of sodium. These waters can be employed internally at Alveneu in some chronic catarrhal conditions of the digestive organs in weak subjects. The season is from June 15 to September 25.

Le Prese, in Switzerland (Canton Grisons), is a summer resort on the Lago di Poschiavo, 3,160 feet above sea-level, half an hour's drive from Poschiavo, and about 6 hours' drive from Samaden. The cold sulphur waters are feebly mineralised (total solids, according to Wittstein, 0·3 per mille), and contain 6 per mille volumes of sulphuretted hydrogen; they are used for baths and for drinking. The bath arrangements and accommodation are satisfactory. The season is from the commencement of June to the end of September.

Serneus (Switzerland), in the Grisons, has a cold sulphur spring with about 9 per mille volumes of sulphuretted hydrogen gas. The establishment lies at an altitude of about 3,240 feet in the Praetigau Valley on the branch railway from Landquart to Davos.

Stachelberg (Switzerland, Canton Glarus), near the railway station of Linththal, possesses a cold sulphur spring, containing rather little sulphuretted hydrogen, but, according to an old analysis of Simmler, 0·04 per mille sulphide of sodium. The spa has a subalpine climate and beautiful position in the Toedi district, 2,050 feet above sea-level. It is resorted to for chronic catarrhal affections of the respiratory passages, scrofulous conditions &c.

Other Swiss cold sulphur waters are those of MONTBARRY (altitude 2,460 feet), in the Gruyères district of Canton Freiburg; L'ETIVAZ (altitude of the small establishment 4,100 feet), near Château d'Oex, in Canton Vaud; FLUEHLI-IM-ENTLEBUCH (altitude 2,930 feet), in Canton Lucerne; and RIETBAD (altitude 2,790 feet), in the Toggenburg district of Canton St. Gall.

Eaux Chaudes (France, Basses-Pyrénées).—The village is situated in the rocky prolongation of the Ossau Valley (altitude

¹ See 'Das Schwefelbad zu Alveneu,' by Victor Weber, third edition by Schnoeller, 1897.

2,050 feet), 3 miles from the railway station of Laruns, and 5 miles by the road from the spa of Eaux Bonnes.

The thermal springs have a temperature of 77–79° F., and are similar in their mineral constituents to those of Eaux Bonnes, but contain less sulphur (sulphide of sodium 0.0088, total solids 0.33 per mille).

The waters (contrary to those of the neighbouring Eaux Bonnes) are employed chiefly for baths and douches (including vaginal and rectal douches). The different springs from old tradition have reputations for different affections; the 'Source Clot' for arthritic affections, the 'Source Esququette' for uterine troubles, &c., the 'Source Rey' for nervous disorders in rheumatic subjects, and the 'Source Baudot' (temperature only 77° F.) for catarrhs of the respiratory organs.

The waters of Eaux Chaudes have a less excitant action than the hotter Pyrenean sulphur waters, but have, it is said, a tendency to produce hyperæmia of the pelvic organs, and thereby to aid in the re-establishment of the menses in chlorotic girls. The spa is chiefly resorted to by women suffering from chronic disorders of the pelvic organs.

There is likewise a cold spring, the 'Source Minvielle,' analogous to the 'Source Froide' at Eaux Bonnes. With the sulphur removed this spring is used as a table water.

A pleasant excursion from Eaux Chaudes is that to the village of Gabas, about 5 miles higher up the valley (southwards). Patients have not so much facility for shady walks as they have at Eaux Bonnes. The season is from the beginning of June to the end of September.

Cambo (France, Basses-Pyrénées) is situated on the Nive, amidst beautiful scenery, at an altitude of about 200 feet above sea-level. Most of the place lies on a plateau considerably above the river. It possesses a gypsum (1.5 per mille calcium sulphate) water (72° F.), containing a little sulphuretted hydrogen, and a cold, weak, non-gaseous chalybeate spring. There are pleasant walks and interesting excursions to be made in the neighbourhood. Owing to the relative mildness of its climate, Cambo, like Pau, forms a pleasant autumn and spring climatic resort, and some delicate persons spend the winter season there. The railway station is 12 miles distant from Bayonne.

Saint-Boès (France, Basses-Pyrénées), according to Dr. F. Garrigou,¹ possesses the most sulphurous water in the Pyrenees (exported only). This water is cold and bituminous, and contains sulphide of sodium and sulphuretted hydrogen, equivalent to 0.156 per mille sulphide of sodium. Garrigou speaks of its utility

¹ *Le Bulletin Médical des Stations Pyrénéennes*, December 1894, p. 47.

in affections of the respiratory and intestinal mucous membranes, and believes that he has obtained good results from its use in cases of pulmonary tuberculosis.

Barèges (France, Hautes-Pyrénées).—This celebrated spa lies in the upper, rather bare part of the valley of the Gave de Bastan, at an elevation of 4,200 feet above sea-level; in summer warm clothing may be required, and the winters are said to be very severe. The waters are thermal sulphurous (temperatures 81° to 111° F.), and do not whiten on exposure to the air as do those of Luchon; they contain an organic substance which forms a scum on the surface, and was named by Longchamp 'Barégine' after this spa. The hotter springs are the richest in sulphide of sodium. In external treatment the tepid baths are used to begin with, and then gradually the hotter ones (sometimes up to 100·5° F.). Local douches are employed sometimes up to 111° F. The hot waters have a powerful nervous excitant action.

Barèges has a very great reputation in the treatment of old gunshot and other wounds, painful cicatrices, and chronic joint affections; there is a large sanatorium for officers and soldiers. Chronic eczema and psoriasis are said to be at least temporarily benefited. Barèges is also resorted to by sufferers from syphilis. The spa became famous in 1675 when the Duc du Maine, natural son of Louis XIV., was treated with good result for a tuberculous affection. Internally used, the waters sometimes give rise to nausea and diarrhœa; they are decidedly less employed for drinking than for bathing. The 'Tambour' spring (temperature 111° F.), which contains 0·04 per mille sulphide of sodium (and a minute quantity of arseniate of sodium), is the only one used internally, and is taken in small doses, often mixed with milk or whey. The season lasts from June 15 to September 15.

Barzun, a spring, a quarter of a mile below Barèges, has a water similar to the Barèges waters (temperature 84° F.). In 1881 the water of Barzun was conveyed by a conduit four miles down the valley to LUZ, a village situated at an altitude of 1,790 feet, 1½ hours' drive from the railway station of Pierrefitte, and only ¾ mile distant from the spa of St. Sauveur. There are now two bath establishments, the old one at the source and the new one at Luz. The Barzun water is less excitant than the hotter Barèges waters, but more excitant than the St. Sauveur 'Source des Dames.'

Saint-Sauveur (France, Department of Hautes-Pyrénées).—The village is situated in one of the most picturesque valleys of the Pyrenees, at an altitude of 2,500 feet, on the Gave de Gavarnie, which joins the Cauterets Gave at Pierrefitte. There

are interesting excursions to be made, but patients have not much variety in walks immediately around the spa.

The 'Source des Bains' or 'des Dames' (temperature 94° F.) supplies the bath establishment and contains about 0·02 per mille sulphide of sodium (and a trace of arsenic). The other spring, the 'Source de la Hontalade' (temperature 86° F.), a few minutes' walk from the village, contains slightly less sulphide, and has a special reputation in cases of gastralgia, like the Mauhourat spring has at Cauterets.

St. Sauveur may be called a 'ladies' spa,' and is mostly used for gynæcological affections and functional nervous disorders. The whole course of treatment (baths, climate, manner of living) exerts a sedative, but not depressing, effect on the nervous system, and has an especially beneficial influence in debilitated and neurasthenic patients with an irritable or erethic tendency, where the general condition may be termed one of 'irritable weakness.' In many of these cases the condition is associated with a more or less chronic purulent discharge from the genital organs. According to local doctors the St. Sauveur sulphurous baths often exert a special stimulant effect on the uterus, and may even provoke what has been termed a 'hydrorrhœa from thermal treatment.' Maurice Faure ('Annales d'Hydrologie,' Paris, September 1899) thinks that they have an eminently 'reconstructive' action, and help to bring about the absorption of the products of uterine and peri-uterine inflammation. Besides the local effect of a course of treatment, a general action is manifested by the better appearance of the patient, and the improvement of physical and psychical functions. Furthermore, there are changes in the blood to be noted, and according to Faure both the hæmoglobin and the number of corpuscles may be greatly increased as the result of a single course of treatment. The St. Sauveur season is from the beginning of June to the end of September.

The establishment of Barzun at Luz can be likewise made use of by patients resident at St. Sauveur, for it is only $\frac{1}{4}$ mile distant.

Bagnères-de-Bigorre (France, Hautes-Pyrénées) possesses the sulphur water of Labassère in addition to its other waters. The spa is described amongst earthy waters in Chapter XXVI.

Cadéac (France, Hautes-Pyrénées) is picturesquely situated at an altitude of 2,360 feet, 2 miles to the south of Arreau, which is half-way on the well-known road between Bagnères-de-Bigorre and Bagnères-de-Luchon. Cadéac possesses cold sulphur waters, almost the strongest in the Pyrenees, containing 0·075 per mille sulphide of sodium. The sulphate of iron water of LE MOUDANG (0·03 per mille) is sometimes made use of here.

Argelès-Gazost (France, Department Hautes-Pyrénées).—Argelès (or Argelès-de-Bigorre) lies at an altitude of 1,520 feet in a broad part of the valley of the Gave de Pau. It is sheltered by an almost complete amphitheatre of mountains. The luxuriance of the vegetation, the fragrance of the air, and the magnificent view on to the Pyrenees, constitute a charm which, with the excellent accommodation, attracts visitors to Argelès in spite of the summer heat.

The recently erected bath establishment is supplied by cold sulphur water conducted from Gazost, 10 miles distant. According to Willm's analysis of 1890, the Grande Source of Gazost contains 0·01 per mille sulphide of sodium and 0·02 per mille sulphide of calcium, whilst the Source Noire contains 0·02 per mille sulphide of sodium and 0·01 per mille sulphide of calcium. Both waters can be given internally, but the latter (brought only in bottles from Gazost) is said to be the best. They are employed in chronic catarrhal conditions of the throat and respiratory organs, and in some gynaecological affections, where much excitation is not desired.

Argelès is very hot during the season (June 15 to October 1), but during spring some English who have wintered at Pau or Biarritz rest here for a time before proceeding to Switzerland or England for the summer. Argelès is a station on the railway from Lourdes to Pierrefitte.

Ax-les-Thermes (France, Department Ariège) is pleasantly situated, at an altitude of 2,340 feet, in the upper part of the Ariège Valley. Owing to the mountainous position its climate is somewhat changeable, and it may become cold in the evenings. The so-called Lepers' Bath (Bassin des Ladres) is said to date from 1260, in the reign of Saint Louis.

There are about sixty thermal springs, with temperatures varying from 65° to 171·5° F., and mostly containing 0·01 to 0·026 per mille sulphide of sodium. The so-called 'degenerated sulphur' waters of Ax, in which the sulphide of sodium has been converted into the hyposulphite and sulphate, may practically be regarded as slightly alkaline simple thermal, or weak earthy waters; they exercise a sedative action, whereas a stimulating action is claimed for the Ax waters in which the sulphur persists as sulphide of sodium.

The Ax waters are used for drinking, baths, douches, inhalation, and hot vapour baths. Owing to the abundant supply and different temperatures and chemical composition of the waters, the balneotherapeutic resources of Ax are more varied than those of most other Pyrenean spas. In time Ax will probably become more widely known out of France than it is at present. It is

visited for rheumatoid arthritis and chronic rheumatic affections, 'torpid' scrofulous conditions, chronic affections of the respiratory organs, chronic skin diseases, and syphilis. The season is from May 15 to October 30. The place is the terminus of a railway from Toulouse. Rooms may be obtained at the Teich Bath establishment as well as in hotels.

Amélie-les-Bains (France, Pyrénées-Orientales) was called Bains-près-d'Arles until 1840, when it was renamed in honour of the wife of Louis Philippe. This spa is situated at an altitude of 920 feet, in a valley shut in by mountains, and although, owing to this fact, in winter the sun shines for a comparatively short time in the day, the winter climate is mild and the mean winter temperature about 46° F. The spa is open all the year round, but on account of the heat is mostly visited during the winter season. The east wind is sometimes disagreeable in spring, the worst time of the year for this spa. (See also Part I, Chapter VIII.)

The various springs yield alkaline sulphur waters, which have a temperature of about 140° F. and contain about 0.016 per mille of sulphide of sodium. They are rich in glairine and organic matter. The Romans made use of the waters, and one of the two civil bath establishments is erected on the foundations of ancient Roman *thermæ*.

The baths are used for skin affections, rheumatoid arthritis, pain in old wounds &c., and treatment by various hydrotherapeutic appliances may be added. The waters are likewise employed in chronic catarrhal conditions of the respiratory organs (see also Part I), for which the mild climate of the spa is tolerably suitable during the winter months. Drinking the waters is recommended in some disorders of the liver and digestive system. There is a large military hospital with baths of its own.

Vernet-les-Bains or **Le Vernet** (France, Pyrénées-Orientales), a pleasant spa with excellent bath arrangements and shady promenades, lies at an altitude of about 2,060 feet, in a southern branch of the Tet Valley at the northern foot of the Canigou Mountain. It possesses thermal sulphur springs (90° to 154° F.), containing sulphide of sodium, up to about 0.04 per mille; the waters are employed for drinking, baths, douches, sprays and inhalation. There are also small thermal swimming baths. Patients resort to Le Vernet for chronic affections of the respiratory organs (see also Part I), chronic rheumatism, cutaneous eruptions, &c. The chief season is in the summer, but one of the bath establishments is open throughout the year. The winter sanatorium ('Sanatorium de Canigou') for cases of pulmonary tuberculosis was opened in 1890.

La Preste (France, Pyrénées-Orientales) is a village situated at an altitude of 3,700 feet, about 20 miles from the railway station of Amélie-les-Bains. Its thermal sulphur waters (temperature 88° to 111° F., total solids about 0·15 per mille) decompose rapidly on exposure to the air. They become alkaline, 'degenerated' sulphur waters, have a diuretic action, and are used in chronic catarrhal conditions of the urinary organs, and in cases of uric acid gravel.

Olette (France, Pyrénées-Orientales) lies in the Valley of the Tet at an elevation of 2,010 feet, not far from Vernet-les-Bains. It possesses a great number of thermal sulphur springs (temperature 90° to 172° F.) containing 0·001 to 0·03 per mille sulphide of sodium. The bath establishments (THUEZ and CANAVEILLES) are situated about 2 miles from the village, at an elevation of 2,300 feet above the sea, and about an hour by omnibus from the railway station of Villefranche-de-Confient.

Molitg (France, Pyrénées-Orientales) lies at an altitude of about 1,475 feet, in the narrow valley of the Castellane, to the north of the Tet Valley, about 5 miles from the railway station of Prades. It possesses several alkaline sulphur springs having temperatures varying from 89° to 100·5° F. and containing from 0·003 to 0·018 per mille sulphide of sodium. The chief reputation is in the treatment of skin diseases.

Les Escaldas (France, Department of Pyrénées-Orientales) is situated close to the Spanish frontier on a plateau, about 4,430 feet above the sea-level. The waters are thermal, and contain sulphide of sodium. The temperature of the 'Grande Source' is 109·5° F.

Uriage (France, Department Isère).—Uriage, about 8 miles from Grenoble, lies at an altitude of 1,350 feet in a beautiful valley of the Dauphiné Alps. The thermal muriated sulphur spring (temperature 81° F.) has a total of 9·7 solids per mille, and, according to Willm (1888), contains 6 per mille common salt, about 1 per mille each of sulphate of sodium and sulphate of calcium, 0·48 per mille sulphate of magnesium, and 0·0001 per mille arsenic. The sulphuretted hydrogen gas present is equivalent to about 7 volumes per mille. In doses of from four to six glasses a gentle laxative effect is usually obtained, and is in many cases sought for at intervals during a course of external treatment.

Uriage is of use in chronic cutaneous affections (eczema, psoriasis, &c.), disorders of the female pelvic organs such as are more particularly connected with disturbance of the general nutrition, and in various chronic scrofulous and rheumatic conditions. Doubtless in great measure owing to the purity of the air and other climatic conditions, the place has likewise an ex-

cellent reputation as a health resort for scrofulous and weakly children.¹

For baths and douches the thermal water can be heated to the required temperature, and the bath arrangements at the establishment are excellent. Massage is frequently combined with the douches, as in the 'douche-massage' of Aix-les-Bains; at Uriage, however, the patient lies on an inclined table during the treatment, which is applied (about 12 to 15 minutes at a time) by one attendant only; the douche is often given alternately warm and cold. Treatment for syphilis is similar to that at Aachen.

The thermal water is likewise used for pulverisation, gargling, and nasal douches. Ordinary water supplies the hydrotherapeutic department.

In the neighbourhood of the establishment, close to the remains of the Roman thermæ, is a practically non-gaseous chalybeate spring (0.02 per mille bicarbonate of iron), which is sometimes employed internally in anæmic cases.

Uriage is a modern health resort remote from towns and factories. The pureness of the air, the luxurious vegetation of the valley, the beauty of the scenery and the shady walks in the surrounding woods must contribute largely to the good effects obtained. The old Château of Uriage, to the owners of which the spa owes its foundation and present development, is perched on an eminence, 300 feet above the establishment, and adds considerably to the picturesqueness of the neighbourhood. The season is from June to October. The station of Gières on the railway between Grenoble and Chambéry is about an hour's drive from Uriage. There is likewise a special steam tramway from Grenoble to Uriage.

Allevard (France, Department Isère) possesses cold sulphuretted hydrogen waters, containing about one half per mille of common salt and about the same amount of sulphate of sodium. The amount of sulphuretted hydrogen is said to be 24 volumes per mille. The waters are used for drinking and for pulverisation and inhalation in cases of chronic catarrhal conditions of the throat, nose, and respiratory organs. A 'milk cure' or a 'whey cure' is employed in some cases. There are likewise arrangements for baths, douches, 'douche-massage,' and vapour baths, so that chronic skin diseases and various chronic rheumatic affections can be treated. Allevard is situated on the banks of the Bréda stream in a pleasant valley at an elevation of about 1,400 feet above sea-level. The thermal establishment was rebuilt

¹ Vide 'Uriage, Station d'Enfants,' by A. Doyon, *Presse Médicale*, March 28, 1903, p. 263.

in 1893, and is satisfactory, though the town itself has a somewhat squalid appearance, and there is a rather noisy factory close to the baths. The arrangements for inhaling the pulverised water or the gases and vapour from the water are especially to be noted. The season lasts from June to September. Allevard is about 6 miles from Goncelin (omnibus in $1\frac{1}{2}$ hours), and is connected by a steam tramway with Pontcharra (8 miles distant); both Goncelin and Pontcharra are on the railway between Grenoble and Chambéry.

Challes (France, Department Savoie), about 3 miles by steam tramway from the railway station of Chambéry, lies at an altitude of about 880 feet, in a valley sheltered from north and east winds. It possesses a strong cold sulphur water, which can likewise be obtained (for internal use) at Aix-les-Bains (*q.v.*). The total of solid constituents in the 'Grande Source' is 1.2 per mille, and the quantity of sulphur, reckoned as sulphide of sodium, is said to be 0.5 per mille; small quantities of iodide of sodium (0.01 per mille) and bromide of sodium (0.003 per mille) are likewise contained according to Willm's analysis.

The water is used for drinking, and for nasal douches, pulverisation &c. in cases of chronic catarrhal conditions of the throat and pharynx, in ozæna, adenoid vegetations, and chronic bronchitis. Baths are employed in some cases of scrofula, syphilitic cachexia, &c. Adjoining the establishment is an old château, which has been transformed into an hotel for those undergoing the treatment. It is a fair distance off the high road, which is often terribly dusty. The season is from June to the commencement of October.

Gréoulx (France, Department of Basses-Alpes) lies at an altitude of 1,140 feet, about $1\frac{1}{2}$ hours distant from Mirabeau, a railway station on the line from Grenoble to Marseilles. Its thermal muriated sulphur water contains about 2 per mille common salt, and is used for baths at its natural temperature of 97° F.

Digne (France, Basses-Alpes; 1,960 feet above sea-level) has thermal muriated sulphur waters, similar to those of Gréoulx.

Bagnols (France, Department of Lozère) lies in the narrow valley of the River Lot, at an altitude of about 2,600 feet, and is 23 miles distant from the railway station of Villefort. It possesses thermal weakly mineralised springs (temperature 95° to 106° F.), containing about 1.7 volumes per mille of sulphuretted hydrogen. The waters are employed for drinking, for hot baths, and for inhalation. Good results are claimed at Bagnols in chronic rheumatism and skin diseases, and also in some chronic cardiac

affections. At all events, it was long ago shown¹ at this spa that thermal baths might be taken without harm, and in some cases with advantage, by patients suffering from chronic rheumatic defects of the cardiac valves, without loss of compensation.

Saint-Honoré-les-Bains (France, Department of Nièvre).—Saint Honoré is pleasantly situated, at an altitude of 990 feet, in a hilly and well-wooded country, at the western foot of some outlying elevations of the Morvan range, which shelters it from the east and north-east. It is about 32 miles east of Nevers.

Its tepid sulphurous and arsenical waters (temperature 80° to 88° F.) were known to the Romans. Their total solid residue is 0·4 to 0·5 per mille. They are slightly alkaline, and contain free nitrogen and carbonic acid and a little sulphuretted hydrogen, of which last gas, however, they have little smell or taste. According to the analysis of Personne in 1880, and of Parmentier in 1894, the 'Source de la Crevasse,' that mostly chosen for drinking, contains an amount of arsenic equivalent to about 0·004 per mille arseniate of sodium.

The thermal establishment, situated in a park, contains baths, douches, pulverisation and inhalation chambers, rooms for gargling, hot vapour baths, and a swimming bath. Douches for the feet are much employed at St. Honoré, sometimes to follow the inhalation of the waters.

St. Honoré is resorted to for chronic affections of the respiratory organs, chronic rheumatism, scrofula, and chronic cutaneous eruptions. The season is from the middle of May to the end of September. The spa lies about 6 miles from the railway station of Vandenesse, on the line between Cercy-la-Tour and Clamecy.

Enghien (France, Department of Seine-et-Oise) is a small town (altitude 160 feet) close to Paris. It possesses cold sulphuretted hydrogen springs (containing also 0·023 to 0·029 per mille sulphide of calcium) and well-arranged establishments. The waters are used for drinking, bathing, douches, inhalation, pulverisation, and gargling.

Pierrefonds (France, Department of Oise).—This little town, celebrated for its feudal castle, rebuilt by Viollet-le-Duc for Napoleon III., stands at an altitude of 275 feet on the side of a small lake below the hill on which the castle rises, at the southern border of the forest of Compiègne. Its cold sulphur spring contains 0·015 per mille sulphide of calcium, small quantities of earthy salts, and 1·4 volumes per mille sulphuretted hydrogen.

¹ See J. E. Dufresse de Chassigne, *Mémoire sur le traitement et la guérison de l'anévrysme rhumatismal du cœur (endocardite rhumatismale chronique) sous l'influence de l'usage des eaux thermales de Bagnols*, Angoulême, 1859.

The waters are especially used in chronic affections of the respiratory organs. Treatment of chronic pharyngitis &c. by pulverisation with the sulphur waters was employed at Pierrefonds by Dr. Sales-Girons¹ as early as 1856. There is also a cold chalybeate spring, said to contain 0.139 per mille bicarbonate and crenate of iron, small quantities of earthy salts, and traces of manganese and arsenic. The season is from June 1 to September 30.

Amongst French sulphide of sodium waters which have not yet been mentioned are the following: TRAMEZAIGUES, COURET, LOUDENVIELLE, GERMS, and BEAUCENS, in the Department Hautes-Pyrénées; MÉRENS (near Ax-les-Thermes), CARCANIÈRES and the neighbouring USSON, in the Department Ariège; ESCOULOUBRE (near Carcanières), in the Department Aude; SAINT-THOMAS and NOSSA-LES-BAINS, in the Department Pyrénées Orientales; BERTHEMENT (31 miles from Nice), in the Department Alpes Maritimes; SAINT-MÉLANY, in the Department Ardèche.

The following may be added to the French waters containing sulphuretted hydrogen: LA CAILLE, in Department Haute-Savoie; CASTÉRA-VERDUZAN and BARBOTAN², (see also Chapter XXIII), both of which have likewise chalybeate springs, in Department Gers; EUGÉNIE-LES-BAINS, TERCIS, and PRÉCHACQ,³ in Department Landes; and CAUVALAT-LE-VIGAN, in Department Gard. FUZET and LES FUMADES, in Department Gard, have cold sulphurous gypsum springs which contain a bituminous material.

Pietrapola, in the island of Corsica, is picturesquely situated in a mountainous region, and possesses thermal sulphur springs (temperature 90° to 137° F.), containing about 0.02 per mille sulphide of sodium.

Guagno, or **Saint-Antoine-de-Guagno**, in the western part of Corsica, about 40 miles north of Ajaccio, possesses thermal sulphur springs and a military hospital. The 'Grande Source' has a temperature of 124° F. and contains 0.02 per mille sulphide of sodium. The waters are employed for skin diseases, old wounds, &c., as at Barèges.

Puzzichello, in the island of Corsica, at a low elevation,

¹ According to Stemmler (*Berliner klin. Woch.* 1906, No. 25, p. 851) Sales-Girons, owing to his inhalatorium at Pierrefonds and the demonstration of his apparatus at the Académie des Sciences of Paris, is to be regarded as the founder of the modern scientific treatment of affections of the respiratory organs by the inhalation of finely pulverised sprays.

² The mud baths are the most important part of the treatment at Barbotan.

³ Préchacq is, however, best classed in the simple thermal group (Chapter XVII). Its chief resources are the thermal waters and mud baths, analogous to those of Dax, which is only about ten miles distant.

possesses cold sulphuretted hydrogen springs, which have a reputation in the treatment of cutaneous affections.

Acqui, in North Italy (Piedmont).—Acqui, a small town 21 miles south-west of Alessandria, on the railway to Savona, can be reached in a few hours from Genoa, Milan, or Turin. It possesses hot muriated sulphur springs, which are mentioned by Pliny and other writers of antiquity, and gave the place (then the chief town of the Statielli, a small Ligurian tribe) its name of 'Aquæ Statiellæ.' The town is clean and healthy, and lies at an elevation of about 480 feet above sea-level, in a pleasant hilly country on the northern side of the Ligurian Apennines. Acqui itself is ~~not~~ a damp place, though between it and Alessandria there is some flat marshy land.

Of the various springs the most important is La Bollente (1·5 per mille common salt), which emerges at 158° F., and in the different chambers has a temperature of 118° to 124° F. The temperature of the other springs is 102° to 142° F. The thermal water is hardly prescribed for internal use, but the supply of La Bollente is so abundant that the inhabitants can always have as much hot water as they like for household purposes. There is also a cold sulphurous spring.

The local application of the hot 'fango,' a mud-like substance impregnated with organic matter and with the salts of the mineral waters, plays the chief part in the Acqui treatment, and may be compared to the similar treatment at Abano, Battaglia, and Valdieri, and to the mud baths of Dax, Saint-Amand, &c. The Acqui mud (fango) is obtained from deposits in the neighbourhood of the thermal springs by digging to a depth of 3 to 6 feet. Before being employed for baths it is kept in reservoirs of the thermal water for a year or so, during which time its consistence becomes somewhat modified, partly probably by the action of living algæ. When ready for use it is of a slaty grey colour, and of a soft homogeneous putty-like consistence. After being used once it is returned to the reservoirs of thermal water, where it is allowed to remain without being used again till the next season.

The temperature at which the mud is employed varies according to the nature of the case, but is usually between 104° and 122° F. (50° C.). A sheet is laid over a couch, and the attendant (with his hands) spreads a thick layer of the mud on the sheet so as to correspond to the part of the patient's body which has to be treated. The patient then lies down with the affected part on the layer of mud, and the attendant proceeds to pack the part up so that the hot mud forms a heavy poultice all over it. The sheet is then folded over the patient, and a blanket added. At this stage the patient is frequently visited by the attending

physician, and after the prescribed time (usually 20 or 30 minutes) the attendant removes the mud and the patient gets into a cleansing bath of the warm mineral water. He is then rubbed down with hot linen, and returns to his bed (which has been specially warmed) to rest for half an hour or an hour. After this, if required, massage is employed, and the patient is free to get up and dress. The mud treatment generally causes free perspiration, and has a marked action on the circulation and respiration, which makes careful medical supervision necessary. The number of mud baths employed varies in different cases, but usually twelve to twenty are given, often with intervening days of complete rest.

Acqui has a special reputation for chronic articular affections of rheumatic or gouty nature or resulting from injury, chronic rheumatic neuritis or 'neuralgia' (sciatica, &c.), and chronic cases of Sir W. Gowers' 'fibrositis' class. Chronic rheumatoid arthritis can often be much benefited by the treatment. For monarticular and local troubles, including ordinary sciatica and analogous cases of neuritis or neuralgia in other parts, the application is made to a single limb or other affected region, and even in general disorders, cases of generalised chronic rheumatoid arthritis &c. the application is seldom made to more than half the body at the same time. In such generalised cases the two halves of the body may be treated on alternate days.¹

There are two bath establishments, one of which is open during winter, and likewise a military thermal establishment and a hospital for the thermal treatment of the poorer classes. The summer time at Acqui is rather too hot for natives of Northern Europe; for these the spring or autumn is generally to be preferred. Acqui is the only North Italian establishment for mud baths kept open throughout the winter.

Vinadio, in North Italy (Piedmont).—The baths lie at an altitude of 4,360 feet, about 7 miles from the village of Vinadio (3,020 feet). They possess thermal muriated sulphur waters and well-known 'natural' vapour baths or 'stufe' (cf. under Monsummano, in Chapter XVII). There are four of these 'stufe' at Vinadio; they are chambers excavated in the rock and the temperature of the moist air is 104°, 115°, 129°, and 131° F. in the different chambers. Applications of the hot mud ('fango') are employed as at Acqui, Battaglia, Valdieri, &c.

Valdieri, in North Italy (Piedmont).—The baths lie at an altitude of 4,425 feet, in the upper valley of the Gesso. They

¹ See also Dr. J. E. Brandt's account of Acqui methods in *Treatment* (1899, vol. iii. No. 13), to which, as well as to the explanations of the local medical men, Dr. A. Toso and Dr. D'Alessandri, the authors are much indebted.

have been classed, like those of Battaglia, in the simple thermal group. (See Chapter XVII.)

Abano (North Italy), one of the Euganean spas. The thermal waters have been described in the muriated group. (See Chapter XVIII.)

Battaglia, in Italy, the best known of the Euganean spas, has often been included amongst the thermal sulphur springs, but its waters contain no sulphur, and are best classed with the simple thermal group. (See Chapter XVII.)

Tabiano (Italy, Province of Parma), 4 miles from the railway station of Borgo-San-Donnino, possesses cold sulphur waters. It is situated in a pleasant valley of the north-eastern declivity of the Apennines. On the crest of a hill above it is the picturesque old castle of Tabiano, at one time a stronghold of the Pallavicini. The muriated waters of Salsomaggiore (*q.v.*) are only 2 miles distant.

Porretta, in Italy (Province of Bologna), lies in the Valley of the Reno, amongst the Apennines, at an altitude of 1,150 feet. It is a railway station on the line from Bologna to Pistoja, 37 miles distant from the former. The thermal waters (temperature 91° to 95° F.), known from ancient times, contain 8 per mille common salt (*Sorgente Leone*), traces of iodides, bromides, and arsenic, a little sulphuretted hydrogen gas, and some of the inflammable carburetted hydrogen or marsh gas. The action of the waters is laxative and diuretic; they are used in cases of hæmorrhoids, 'abdominal plethora,' &c., and externally for chronic rheumatic and cutaneous affections. The marsh gas likewise exudes from fissures in the Sasso-Cardo Mountain above the town, and, according to Macpherson, can be collected in such considerable amounts that it has been at times utilised for lighting the town. The season is from June 30 to September 30.

Riolo, in Italy (Province of Ravenna), is situated in the fertile valley of the Senio, at an altitude of 520 feet, about 6 miles from Castelbolognese, a station on the railway between Bologna and Ancona. The waters of the strong sulphurous 'La Breta' (25 per mille volumes of sulphuretted hydrogen gas) are conducted to Riolo from a distance of 2½ miles. The other springs belong to the muriated group. The thermal establishment is modern.

The waters of **Viterbo**, **Acqua-Santa**, and **Acque-Albule**, in the region of Rome, are thermal sulphurous. According to Commaille and Lambert (1860) the last-mentioned water (75° F.) contains about 1·4 per mille bicarbonate of calcium, 0·017 per mille sulphide of calcium, and 6·9 per mille volumes of sulphuretted hydrogen gas. The thermal establishment of Acque-Albule is a

station both on the railway and on the tram line between Rome and Tivoli.

Civita Vecchia, the seaport of Rome, possesses thermal waters. The principal spring, Ficoncella, has a temperature of about 132° F. and is slightly sulphurous. There are likewise natural vapour baths.

Acireale, a flourishing town of Sicily, lies at an altitude of 560 feet, near the coast, on the south-eastern slope of Mount Etna. It is used as a winter climatic health resort, and possesses the 'Santa Venera' muriated sulphur wells (70° F.), which contain, according to Silvestri (1872), 2·6 per mille common salt, 0·01 per mille iodide of sodium, and, in 1,000 volumes, 10 volumes of sulphuretted hydrogen, 95 of carbonic acid, 21 of nitrogen, and 10 of carburetted hydrogen or marsh gas. The more elevated position of Acireale gives it some advantages as a climatic station over Catania, which lies 9 miles to the south.

Sciaccia, on the south-western coast of Sicily, 22 miles from the railway station of Castelvetro, occupies the site of the ancient 'Thermæ Selinuntinæ.' It possesses thermal muriated sulphur waters (temperature 122°–125·6° F.) and thermal slightly gaseous alkaline chalybeate springs (82°–100° F.).¹ Not far off is the natural vapour bath ('stufa') of SAN CALOGERO² (known from ancient times), the temperature of which varies in different portions from 96·8° to 107·6° F., and is therefore somewhat higher than that of the famous grotto or natural vapour bath of Monsummano (*q.v.*).

Panticosa (French, PENTICOUSE), in Spain (Huesca), is situated at an altitude of about 5,600 feet in the Pyrenees, near the French frontier, 12 hours' ride from Eaux Chaudes. The spa lies 5 miles from the village of Panticosa, and has almost the highest situation amongst European bathing resorts. St. Moritz, in Switzerland, is, however, higher.

The principal spring, chiefly used for drinking, is called 'del Hidalgo,' or the 'liver spring,' and this, as well as the 'Fuente de los Herpes' (i.e. 'eruption spring') and the 'Fuente de la Laguna,' may be classed amongst the simple thermal or sub-thermal waters (temperature 77° to 84·5° F.); they are rich in nitrogen gas. The 'Fuente del Estómago,' or 'Stomach spring' (temperature 84·5° F.), is a sulphurous spring containing 0·002 per mille sulphide of sodium and some sulphuretted hydrogen

¹ Compare the thermal chalybeate waters of Lamalou in France, Szliacs and Vihnye in Hungary, and Caledon in South Africa.

² Another 'Stufa of San Calogero' is mentioned by Schivardi and others as situated in the island of Lipari to the north of Sicily.

gas. Inhalation of nitrogen gas is employed as at Lippspringe (Germany) &c.

Climate must take a great share in the results obtained at this spa, which is especially visited for chronic pulmonary tuberculosis and affections of the respiratory organs; much less for dyspeptic conditions and chronic skin eruptions. The health resort is open from June 15 to September 15. There is no winter season as at Davos, St. Moritz &c. in Switzerland.

The hot sulphur springs of **Ledesma** (Province of Salamanca) and of **Montemayor** (Province of Caceres) attract a great number of Spanish patients with chronic rheumatic affections, &c.; both these spas have beautiful situations at medium altitudes (above 2,000 feet).

Other thermal sulphur waters in Spain are those of **CORTEGADA** and **CARBALLINO**, in the Province of Orense; **CALDAS-DE-REYES**, **CALDAS-DE-CUNTIS**, and **CALDAS-DE-TUY**, in the Province of Pontevedra; **CARBALLO**, in the Province of Corunna; **ONTANEDA**, **ALCEDA** and **LIERGANES** (subthermal and cold earthy sulphur springs), in the Province of Santander; and **LA PUDA** (temperature of waters about 86° F.), in the Province of Barcelona. **SANTA AGUEDA** (altitude 820 feet), in the Province of Guipuzcoa, possesses cold earthy sulphuretted hydrogen waters; and similar waters occur at **ARECHAULETA**, **ESCORIAZA**, **ARAMAYONA**, and **ELORRIO**, all in this neighbourhood. **PARACUELLOS** (altitude about 2,000 feet), in the Province of Zaragoza, near Calatayud, has cold sulphurous waters, containing common salt and earthy sulphates.

Archena (Spain, Province of Murcia) has thermal muriated sulphur waters (125° F.), which are much frequented by Spanish patients for syphilis and chronic rheumatic affections. The baths lie at an altitude of about 760 feet in a fertile country, 5 miles from the railway station. Owing to the great heat the season is interrupted during the months of July and August.

Carratraca (Spain, Province of Malaga) is situated in a beautiful country (altitude about 1,800 feet), about 28 miles from Malaga. Its sulphuretted hydrogen waters (temperature about 63° F.), which contain a little arsenic, are employed for chronic affections of the female pelvic organs, chronic cutaneous diseases, &c. It was formerly more frequented for syphilis. The season is interrupted during the hottest part of the year.

Chiclana (Spain, Province of Cadiz) may be mentioned here. It has muriated sulphated sulphurous waters (about 64° F.).

Caldas-de-Rainha (Portugal, Province of Estremadura) possesses weak thermal muriated springs, containing sulphuretted hydrogen gas (temperature 96° F.). The water is used internally and externally for chronic rheumatic affections &c. This spa is

the most frequented one in Portugal, and is beautifully situated. There are two hospitals.

Other Portuguese thermal sulphur waters are those of CALDAS-DE-VIZELLA and the very hot waters of SAN PEDRO-DO-SUL (about 152° F.).

Piatigorsk (Russia) lies at an altitude of 1,685 feet on the south-western slope of the Mashuka Hill, an outspur of the Caucasus Mountains, and possesses thermal muriated sulphur springs, having temperatures from 83·5° to 117° F. A kind of diluted mud bath is likewise made use of, the mud for which is obtained from Lake Tambukan, 7 miles distant. According to Dr. F. G. Clemow, Piatigorsk is a town of over 15,000 inhabitants, and the scenery in the neighbourhood is very beautiful. Though very cold in winter, the climate in summer during the season (May to September) is said to be pleasant. The Maria Theresa spring at the little German colony of KARRAS, about 5 miles from Piatigorsk, yields the 'bitter water of the Caucasus,' an aperient sulphated water, not unlike the well-known one of Hunyadi Janos.

Goriatchevodsk and **Bragoun**, in the Caucasus (Russia), possess very hot sulphur waters, containing, it is said, traces of naphtha.

Kemmern (Russia), in Livonia, has cold sulphur springs. Mud baths and sea baths are likewise made use of.

Busk, Busko, or Bousk, in the south of Russian Poland, has sulphur waters and mud baths.

Thermopylæ, near Lamia, in Greece, famous for its historical associations, has very hot sulphur waters, up to about 150° F.

Sandefjord, in Norway, is a small town prettily situated on a little 'Fjord' on the North Sea, about 4 or 5 hours by railway from Christiania. It is the oldest mineral water station in Norway (the bath-house was built in 1837), and contains cold gaseous muriated sulphur springs, used for drinking and bathing. There are also a chalybeate spring (containing, it is said, 1·29 per mille sulphate of iron and some alum) and a cold weak muriated spring with 4·4 per mille common salt.

Cold and hot sea-water baths are made use of, and a sulphurous slimy material found in the Fjord¹ is employed for rubbing the body, and in the form of hot applications for chronic articular rheumatism, &c. This practice was adopted from that existing at the marine spa of STRÖMSTAD (see Part I, Chapter VI), in Sweden. Another curious practice is the application of living Jelly Fishes (*Medusa aurita*, *Cyanea capillata*) to produce a sort

* See the old account by Ebbesen and Hörbye, *The Sulphurous Bath at Sandefjord in Norway*, English translation, Christiania, 1862.

of counter-irritation of the skin in chronic rheumatic affections, sciatica, &c. The season is from the beginning of June to September 1.

Laurvik (Norway), on the Laurvikfjord, near the mouth of the Laagen, 5 or 6 hours by railway from Christiania, possesses sulphurous and chalybeate springs, and a thermal establishment well known in Norway. A fine plantation of beeches is a feature of the spa. Besides the sulphur baths, sulphurous mud applications and Jelly Fishes are employed in the treatment of cases, as at Sandefjord (*q.v.*).

Helouan, in Egypt, 15 miles south of Cairo, has been already described in Part I. The warm springs date their modern reputation from 1868, when Ismail Pasha appointed a scientific commission to investigate them. The muriated sulphur waters (90° F.) contain 5 per mille common salt and an amount of sulphuretted hydrogen gas corresponding to about 60 volumes in a thousand volumes of the water. There are likewise simple muriated and muriated chalybeate waters. The new thermal establishment is efficient, and the accommodation good. Helouan has a desert climate, and is suitable for residence from the middle of November to the middle of April. During this season the climate at European bathing resorts, such as Aachen (the waters of which are likewise thermal muriated sulphurous), is unsatisfactory for many cases of chronic rheumatoid arthritis which might be greatly benefited both by the winter climate and the hot bath treatment at Helouan. Owing to the thermal establishment and facilities for baths, douches and massage in baths, spa-treatment in the class of cases which Gowers has grouped together under the term 'fibrositis' can be well carried out. A winter course at the baths of Helouan might also be recommended in other affections which in summer would be treated by thermal baths and douches at sulphurous or muriated springs in Europe. A modification of the Aix douche-massage treatment (*cf.* under Aix-les-Bains) is practised at Helouan; in fact, no douche at all is employed in this Helouan method (H. O. Hobson), but the patient's whole body is kept under water, whilst the two attendants, having no hose-pipes to manipulate, can devote all their attention to the massage. The thermal water is allowed to run through the bath continuously, and is not diluted with ordinary hot water. There is now a golf-course on the sands at Helouan.

The thermal sulphurous baths of **Hammam-Meskoutin**, in Algeria, have already been described in Part I.

CHAPTER XXVI

EARTHY OR CALCAREOUS WATERS

THESE waters (see Chapter XIII) differ much in the proportion of their constituents. Some of them, such as Bath and Loècheles-Bains, have for greater convenience been classed under the simple thermal waters; others, such as Baden in Switzerland, and Schinznach, under the sulphur waters. We have not thought it necessary to separate the alkaline earthy waters from the gypsum (sulphate of calcium) waters, but have included both in the present chapter, and in order to show the relative amounts of calcium sulphate, calcium bicarbonate, and magnesium bicarbonate in some of the best known springs, we give the following table:

Name of water	Calcium sulphate per mille	Calcium bicarbonate per mille	Magnesium bicarbonate per mille
Wildungen (Helenenquelle)	—	1·2	1·3
Wildungen (Georg-Victorquelle)	—	0·7	0·5
Contrexéville (Source Pavillon)	1·5	0·4	0·03
Bath (King's Well)	1·3	0·1	0·01
Lippspringe (Arminiusquelle)	0·8	0·2	0·3
Bagnères-de-Bigorre (Source Saint-Roch)	1·8	0·1	0·003
Pougues (Source Saint-Léger)	—	1·7	0·4
Weissenburg	0·95	0·05	0·04
Bagni-di-Lucca (Bagni-Caldi)	1·7	(0·02 ?)	(0·02 ?)

Alkaline earthy waters, owing to their alkalinity and astringent effect, act beneficially in digestive troubles, with tendency to attacks of diarrhoea and undue irritability of the mucous membrane.¹ Several spas of this class enjoy likewise a considerable reputation in chronic catarrhal conditions of the respiratory organs.

Whether in cases of osteomalacia, rickets, and tuberculosis, earthy waters have any special therapeutic value beyond that of aiding digestion, seems doubtful.

To their diuretic action (Chapter XIV) waters such as those of Contrexéville probably owe part of their repute in cases of

¹ For the use of alkaline earthy waters in various cases of dyspepsia, see the paper by Dr. M. Platkowsky in the *Wiener klinische Wochenschrift*, 1898, No. 1, p. 10; see also the paper on the action of the Pougues waters, by Dr. Hérard de Bessé, in *Annales d'Hydrologie*, Paris, 1898, vol. iii.

urinary gravel and chronic catarrhal conditions of the bladder and urinary passages, but there is likewise some evidence¹ that the administration of calcium carbonate (and chalky mineral waters) tends to diminish the amount of uric acid excreted in the urine (and perhaps in some way diminish the formation). The chalk in the waters of Wildungen &c. appears not in any way to increase the size of urinary concretions, unless in the case of phosphatic calculi they indirectly favour fresh deposits by increasing the alkalinity of the urine. Debout d'Estrées in fact maintains that when the alkalinity of the urine is due to vesical catarrh, the effect of the Contrexéville water, owing to its favourable action on the cystitis, is to remove rather than augment the alkalinity. At all events one may say that even long-continued use of alkaline earthy waters does not seem to make the urine alkaline in individuals whose urine is usually acid. Whether any of these waters have the power which has been claimed for them of inducing the breaking up and expulsion of urinary calculi, appears doubtful; such calculi have been known occasionally to undergo spontaneous fracture and expulsion.

Karl Grube,² of Neuenahr, has directed attention to the possible use of calcium carbonate ('egg-shell treatment') in diabetes mellitus, but it does not seem likely that calcareous mineral waters would be useful (unless in gouty cases?), since in 'benign' diabetes, which includes the cases most suitable for spa-treatment, he found the calcium carbonate to have no effect at all.

In chronic skin diseases, such as chronic indolent eczema and psoriasis, the action of earthy waters (such as those of Loèche-les-Bains), when used in the form of prolonged tepid baths, by soaking the skin and exciting an inflammatory cutaneous reaction or 'poussée thermale,' is doubtless more important than any special action exerted by the solid mineral constituents present in solution.

It is possible that the internal employment of calcareous waters, owing to the calcium salts which they contain, might be useful in some cases of chronic and recurrent urticaria, chronic headache &c. which are associated with deficient coagulability of the blood.³

¹ Some experiments carried out by J. Strauss and by Herzheimer at the suggestion of C. von Noorden are referred to in H. Kionka's interesting paper in the *Berliner klin. Wochenschrift*, January 1, 1900, p. 8. See also Kionka's experiments in regard to the preventive action of the salts of alkaline earthy mineral waters &c. on artificial gout in birds (*Medizinische Woche*, 1904, No. 9).

² *Münchener med. Woch.* 1895, No. 22, and *Therapeutische Monatshefte*, May 1896.

³ See A. E. Wright, 'On the Treatment of Hæmorrhages and Urticarias which are associated with Deficient Blood Coagulability,' *Lancet*, January 18, 1896, and 'On the Association of Serous Hæmorrhages with Conditions of Defective Blood Coagulability,' *Lancet*, September 19, 1896; A. E. Wright and W. E. Paramore, 'On Certain Points

Amongst the spas of this group, Wildungen and Contrexéville will be described first, and the rest arranged in political geographical order.

Wildungen (Germany, Principality of Waldeck).—Wildungen is picturesquely situated in an open valley at an elevation of about 980 feet above the sea-level, and is fairly sheltered from cold winds. Bad-Wildungen proper is the western portion of the town, and consists nearly entirely of one long street, the 'Brunnen-Allée,' in the villas and hotels of which most of the patients lodge. The neighbouring woods afford delightful walks to those patients for whom open-air exercise is recommended.

At the western end of the Allée is the Georg-Victorquelle, medicinally made use of at least since the sixteenth century; here, during the season, the band plays in the morning, whilst the patients drink their water. The Helenenquelle is situated in the beautiful Helenenthal, about half an hour's walk in a south-westerly direction from Wildungen. The Königsquelle, near the railway station, is private property. These three cold gaseous springs contain 0.5 to 1.3 per mille of the bicarbonates of calcium and magnesium, and 0.018 to 0.036 of bicarbonate of iron. The Georg-Victorquelle is the least strongly mineralised (total solids, 1.5 per mille), and but for its containing about 0.029 per mille bicarbonate of iron, might be classed as a 'table water.' The Königsquelle contains the most iron (0.036 of the bicarbonate), whilst the Helenenquelle contains 0.84 per mille bicarbonate of sodium, and both of them contain a little over 1 per mille of each of the three salts—bicarbonate of calcium, bicarbonate of magnesium, and common salt. Calcium sulphate (gypsum) is apparently absent from all three springs.

Besides the above-mentioned three springs there is the (but little used) earthy chalybeate 'Thalquelle,' about 2 miles distant from the town, and near it is the 'Stahlquelle,' a strong fairly pure chalybeate spring (0.07 per mille bicarbonate of iron), rich in carbonic acid gas. For the convenience of patients the waters of the Stahlquelle and the Helenenquelle, as well as milk and whey, are supplied at the Georg-Victorquelle.

The bath-house, which is also a dwelling-house ('Badelogirhaus') for patients who care to live there, is situated close to the Georg-Victorquelle, but is supplied by a separate spring. There is likewise a small bath-house at the other end of the town, attached to the Königsquelle.

in connection with the Exaltation and Reduction of Blood Coagulability by Therapeutic Measures,' *Lancet*, October 14, 1905; W. E. Paramore, 'An Experimental Study of Some Cases of Urticaria,' *Brit. Journ. of Dermatology*, 1906, Nos. 7, 8; G. W. Ross, 'On the Relief of Certain Headaches by the Administration of one of the Salts of Calcium,' *Lancet*, January 20, 1906.

The patients who resort to Wildungen nearly all suffer from affections of the urinary system, or at least have symptoms resembling those due to one of these affections. There are patients with vesical calculus, chronic cystitis, pyelitis, enlarged prostate and its results, gonorrhœa, and urethral stricture. Some suffer from uric acid gravel, and some have slight albuminuria, with or without organic affection of the kidneys.

The diet in the hotels is regulated to suit the class of cases chiefly met with at Wildungen; beer, mustard, highly seasoned and rich dishes are hardly to be seen on the tables; patients are especially recommended to observe great moderation in alcoholic drinks and sweet dishes. It must not, however, be supposed that Wildungen is resorted to merely by patients, for its agreeable situation attracts other visitors (friends of patients &c.) and tourists, and will probably cause it to become still more esteemed as a summer resort than it is at present.

The waters are taken in the morning before breakfast, often again at noon, before the midday meal, and sometimes once more in the afternoon. The water, in the case of many patients, is best warmed before drinking, though much of the carbonic acid gas must thereby escape. For this purpose troughs of hot water, as at many other spas, are supplied, and the glasses containing the mineral water are placed in them for a minute or two; the mineral water may likewise be warmed by the addition of a little hot water or hot milk. Sometimes the mineral water is not well borne on an empty stomach, and in such cases the patient may be advised to take a cup of tea or coffee first, or to add milk or whey to the water before drinking it.

The baths are prescribed for only a small proportion of patients; for example, such as suffer from the uric acid diathesis or kidney troubles, or to strengthen the action of the vesical musculature in atonic conditions. The water of the baths is usually warmed to 77°–99° F., and a stimulating effect (sea-salt or alkali is sometimes added) is produced by the bubbles of carbonic acid gas which move along the skin of the bather. The baths are usually taken in the forenoon, an hour or thereabouts before the midday meal. They are not prescribed when there is any tendency to hæmorrhage.

It is, however, the operative skill of the resident medical men that has given Wildungen the reputation that it possesses as 'a surgical spa' in diseases of the urinary organs, a reputation which Marc considers originally in great part due to Stöcker. Vesical calculi are got rid of by lithotripsy, strictures of the urethra are dilated or cut, and other surgical methods of treatment are employed. It is not, of course, maintained that mere drinking

of the waters can cause solution of vesical calculi, or relaxation of a urethral stricture, though it may render the condition for operative interference more favourable.

The greater part of the patients are men, but women come for gravel and for various urinary troubles; sometimes also, it is said, for an irritable condition of the bladder, not due to cystitis, but secondary to other pelvic troubles.

The Helenenquelle, owing to its alkalinity, is preferred to the Georg-Victorquelle in cases of much irritability of the bladder with highly acid urine; and owing to its being more easily borne by the stomach, it is preferred in most cases at the commencement of the course, especially if there be any tendency to constipation. On the other hand, the Georg-Victorquelle is more suitable when there is much vesical catarrh, with alkalinity of the urine, or when there is phosphaturia without mucus or muco-pus. When the patient is anæmic the Stahlquelle often forms a useful adjunct to the cure.

When, in addition to the urinary trouble, there is a tendency to bronchitis, or digestive disturbances, these associated conditions are often to be relieved by the alkaline waters of the Helenenquelle, the wholesome diet provided, and the pure refreshing forest air. Owing, however, to the special reputation of Wildungen, it is less known as a health resort for such disorders, when not associated with urinary troubles, than some other places with waters belonging to the same class. The principal season lasts from May 10 to September 25, but patients can be received in Wildungen at all other times of the year.

Contrexéville (France, Department of Vosges).—The village (altitude 1,150 feet) is a railway station on the branch line between Chalindrey and Nancy. There are several springs of cold earthy water, the most famous of which, the 'Source Pavillon,' was first analysed and made known by Bagard in 1760, and contains, according to Debray (1864), 1·5 per mille sulphate of calcium, 0·4 per mille bicarbonate of calcium and minute quantities of iron, arsenic, and fluoride of calcium. The Contrexéville waters are employed for drinking in rather large amounts, producing diuresis, and having a slightly laxative effect. Baths and douches are occasionally employed as adjuvants to the internal use of the waters.

The reputation of the spa is very great for affections of the urinary organs, which are 'washed out' by the treatment; for uric acid gravel, and gouty oxaluria, and for chronic cystitis. There are stories of vesical calculi undergoing spontaneous fracture in the bladder, and being passed in the urine, whilst the patients are under treatment, but this does occasionally, though rarely,

occur elsewhere, without drinking medicinal waters. Contrexéville is of use for some gouty conditions in weak subjects, for gouty glycosuria, and according to French authorities for various hepatic complaints.

Its occasional use in children with nocturnal enuresis has been maintained by Dr. Debout d'Estrées, and is confirmed by Sir F. R. Cruise, of Dublin, who knows of a number of obstinate cases cured by the dietetic use of the 'Source Pavillon.' Besides removing any specially irritating quality of the urine, which may act as an exciting cause of the nocturnal incontinence, it is suggested that the mineral water may exercise a local tonic action in such cases.

Amongst contra-indications to the Contrexéville treatment may be mentioned extreme loss of vesical contractile power, great liability to prostatic congestion, and grave diseases of the cardiovascular system.¹

The water is generally taken in the morning only, and not, as sometimes at the neighbouring spa of Vittel, in the afternoon likewise. The doctors at Contrexéville find that if the water is taken with meals, or in the afternoon as well as in the morning, it is apt to act on the bowels during the night time.

Ordinarily the course lasts about twenty-one days. The patient begins with two or three half-glasses, and the quantity is gradually increased till in usual cases six or even more glasses, each holding about a third of a litre, are taken in the morning, with about half an hour's interval after each glass. The patient has to rise very early when he drinks much, for he ought to finish drinking at least an hour before breakfast, a meal generally taken at 10 o'clock. Dinner time is about 6 p.m. The English, instead of the big meal at 10, often take only a very small breakfast, have luncheon later on (about 1 o'clock), and dine at the usual French time.

The situation of the spa in a shallow valley (of the Vair) on a broad elevated plateau of the Monts Faucilles makes the climate fairly bracing, and visitors should be furnished with warm clothes. There is nothing peculiar about the amusements at Contrexéville. Music is provided before breakfast and in the afternoon, and the mode of passing the time is the same as at other spas. Most people find the life pleasant. The season lasts from the end of May to the middle of October. There are now express trains from June 1 to September 20, by which Contrexéville may be reached in little more than 6 hours from Paris.

¹ Compare *Trente Années de Pratique Médicale à Contrexéville*, by Dr Debout d'Estrées, 1898, p. 150.

Bath, in England.—This spa has been placed in the simple thermal group (see Chapter XVII).

Lippspringe (Prussia, Province of Westphalia), $5\frac{1}{2}$ miles from the railway station of Paderborn, lies at an altitude of 450 feet, in a plain, to some extent protected on the north-east by the Teutoburger Wald. The weak earthy water of the Arminiusquelle (temperature 70° F.), having a total of 2.4 solids per mille, contains about 0.7 per mille each of sulphate of calcium and sulphate of sodium, with smaller quantities of earthy carbonates, and 0.015 bicarbonate of iron. About 83 per cent. of the gas given off from the water consists of nitrogen. The rest is carbonic acid gas with minute quantities of oxygen and carburetted hydrogen. These waters are used for drinking, bathing, and for inhalation¹ of nitrogen gas, but in recent years less for bathing and inhalation than formerly. The majority of patients who visit Lippspringe come there on account of chronic tuberculous disease of the lungs, for the treatment of which the spa obtained a considerable reputation, especially after the writings of the late Dr. Rohden. The rather moist equable summer climate of Lippspringe must relieve the irritable cough and bronchitic complications in many chronic and quiescent cases of phthisis, and the internal employment of the Arminiusquelle probably facilitates expectoration. The increase of appetite due to the country air, the wholesome nutritious diet, and the quiet mode of life, are important elements in the treatment. The mineral water is generally taken twice daily, but weak patients are permitted to take the morning dose in their rooms. A small plantation of firs close to the establishment is a favourite place for patients to walk in. Season: May 15 to September 15.

Inselbad, $\frac{1}{4}$ hour's distance from Paderborn, is an establishment for the treatment (i.e. a form of sanatorium treatment) of asthma and allied affections. The 'Ottilienquelle' (temperature 58° F.) is a weakly mineralised earthy spring, containing 40 per mille volumes of nitrogen, and some carbonic acid gas. There are arrangements for inhalation treatment, douches, &c.

Driburg (Prussia, Province of Westphalia) has been described with the chalybeate spas in Chapter XXIII. Amongst its alkaline earthy chalybeate springs the Hauptquelle contains as much as 1.4 per mille calcium bicarbonate. The Caspar-Heinrich-Quelle is compared to the Georg-Victor-Quelle at Wildungen.

Rappoltswiler, in Upper Alsace, is situated at an altitude of 820 feet at the foot of the Vosges Mountains, $2\frac{1}{2}$ miles from the railway station. The Carolaquelle (62.5° F.) is a weak alkaline earthy water with a total solids, according to R. Fresenius and

¹ A Gradirhaus-like arrangement is employed for the inhalation treatment.

E. Hintz, of only 1.79 per mille. The water is used for drinking, inhalation, baths and douches; likewise for a swimming bath. Rappoltsweiler is also used as a climatic resort in cases of emphysema, &c.

Brueckenau, in Bavaria. The alkaline earthy Wernarzerquelle has been already referred to in Chapter XXIII.

Krynica, in Galicia.—Its alkaline earthy chalybeate waters have already been alluded to in the chalybeate group (see Chapter XXIII).

Szkleno (Hungary) is picturesquely situated in a deep well-wooded valley, at an elevation of 1,230 feet above sea-level, some distance to the north of Schemnitz, and 2½ hours' drive from the railway station of Garam-Berzencze. Its thermal waters (99.5° to 128° F.) resemble those of Loèche-les-Bains, and contain 2 per mille sulphate of calcium. It possesses a natural vapour bath (temperature about 100° F.) analogous to the grotto of Monsummano, in Italy.

Weissenburg (Switzerland, Canton of Bern).—The principal ('new') establishment is situated at an altitude of 2,820 feet, 1¼ miles from the village of Weissenburg, in a thickly wooded, sheltered valley leading north-west out of the Simmenthal. The smaller ('old') establishment lies about ½ mile higher up the valley in a romantic gorge. The medical use of the spring dates at least from the early part of the seventeenth century. The dense vegetation (chiefly pine and beech trees), the freedom from dust, the absence of winds except the ordinary refreshing valley currents, and the numerous shady walks on both sides of the ravine above the torrent must be especially mentioned. According to H. Schnyder, the mean relative humidity during summer is rather high, doubtless owing to the forest, and to the spray from the torrent and waterfalls.

The mineral water (temperature 79° F.), which tastes like ordinary drinking water with the chill taken off, is practically only used internally; it contains, according to Stierlin's analysis (1875), 0.95 per mille sulphate of calcium¹ and a smaller amount of sulphate of magnesium; owing to its small total of solids (1.39 per mille) it may likewise be classed in the simple thermal (subthermal) group. It exerts a diuretic action, and is said to cause constipation at first, but later on relaxation of the bowels. The dose commenced with is small, sometimes only about an ounce, but the quantity may be increased gradually until about a pint or more is taken in the day. If much constipation is caused, a little sulphate of magnesium can be added to the minute amount which the

¹ Phosphate of calcium has been noted in the Weissenburg water, but, according to Stierlin's analysis, the total amount present is only 0.0004 per mille.

spring water naturally contains. In affections of the respiratory organs the water is held to make expectoration easier. In the case of all weak patients Huguenin advises that the early doses of the water be taken in bed, in order to avoid any over-fatigue.

Affections of the respiratory organs, including notably the early stages of pulmonary tuberculosis, form the chief class of cases treated at Weissenburg; the climate, general hygienic conditions, and calming influences of the site, play doubtless a large part in the results obtained. The season lasts from May 15 to September 30. The principal establishment may be reached by carriage in about $3\frac{1}{2}$ hours from the railway station of Thun.

Faulensee-Bad (Canton Bern) has an altitude of about 2,600 feet, and lies about 20 minutes distant above the village of Faulensee, a landing station on the southern side of the Lake of Thun. The view across the Lake is magnificent. The cold mineral water, according to Müller and Simmler, contains about 1.5 per mille sulphate of calcium, a minute amount of bicarbonate of iron, and a trace of sulphuretted hydrogen.

Loèche-les-Bains, in Canton Valais, Switzerland.—This spa has been described in the simple thermal group (see Chapter XVII).

Saxon (Switzerland, Canton of Valais), a station on the railway from Lausanne to Brigue, lies in the Valley of the Rhone at an elevation of 1,560 feet. Its weakly mineralised earthy waters have a total of about one part solids per mille, and contain minute quantities of the bromides and iodides of calcium and magnesium, but the iodides are said by Dénériaz to be occasionally for short periods altogether absent. The place is at present hardly, if at all, visited for its waters. The climate is not bracing and the heat is often excessive.

Bergün, a village in Canton Grisons, Switzerland, is a summer resort, situated on the western slope of the Albula pass at an altitude of about 4,550 feet. It possesses a gypsum spring (total solids 1.4 per mille), containing a minute quantity of bicarbonate of iron.

Vals, in Canton Grisons, possesses the sulphate of calcium St. Peter's spring, with a temperature of about 77° F. and a total solids of about 2 per mille. The establishment lies in the Valserthal, 5 minutes from Vals-am-Platz (4,090 feet). The baths are little used.

Peiden (Switzerland, Grisons) is beautifully situated in the Lugnetz Valley, at an altitude of 2,700 feet, about $3\frac{1}{2}$ miles to the south of Ilanz. It possesses cold gaseous alkaline earthy waters (total solids 3.6 per mille) containing a moderate amount of bicarbonate of iron (0.02 per mille).

Bagnères-de-Bigorre (France, Hautes-Pyrénées) is beautifully situated at an altitude of 1,805 feet, in the Valley of the Adour,

and its thermal waters were known to the Romans, as its name (Bagnères is the Latin 'Balnearia') shows. It possesses three groups of waters: (1) earthy and simple thermal; (2) chalybeate; and (3) sulphurous.

The *first group* is the most important, and some at least of its members may, like the waters of Loèche-les-Bains (Chapter XVII), be equally well classed as simple thermal waters. At the head of the first group must be placed the abundant 'Source Salies,' the hottest spring of Bagnères. Its temperature is 123° F., and according to the analysis by Willm it contains 1·8 per mille sulphate of calcium, 0·38 sulphate of magnesium, 0·12 bicarbonate of calcium, 0·0016 bicarbonate of iron, and 0·0003 arseniate of sodium. Of very similar mineralisation are the springs, La Rampe (temperature 95° F.), Platane (temperature 91·5° F.), Dauphin (temperature 120° F.), St. Roch (temperature 105·8° F.), Des Yeux (temperature 91·5° F.), Foulon (temperature 95° F.), La Peyrie (temperature 77° F.), and the springs of Salut (temperature 89·6° to 91·4° F.). The waters of the first group can be employed internally and externally, according to special indications, in gastralgia and irritable functional nervous disorders, in some chronic urinary and uterine affections, and in some chronic rheumatic conditions. The Source Salies, as excavations have shown, was certainly employed by the Romans.

The *second group* includes various chalybeate springs, some of which contain also a little arsenic. They are, however, not gaseous like the well-known chalybeate springs of Spa and Schwalbach.

The *third group* consists of the cold sulphur water of LABASSÈRE (7½ miles from Bagnères), which is conveyed to the spa in closed receptacles. According to the analysis of Willm it contains 0·046 per mille sulphide of sodium; it is used, like the waters of Eaux Bonnes and Cauterets, in chronic catarrhal conditions of the pharynx, larynx, and bronchi.

The main bath establishment of Bagnères is supplied by the Source Salies and several of the other springs. It is here also that the water of Labassère may be obtained.

In the 'Néothermes,' in the same building with the Casino, are piscines for the use of several persons together; they are supplied by the Source Salies, and used for prolonged baths after the fashion of Loèche-les-Bains (see Chapter XVII). There is likewise a larger swimming bath.

The establishment of SALUT is about a mile distant from the town, but patients can be conveyed there in vehicles provided for this purpose.

The season is from the middle of June to the middle of October, but the baths are open all the year round. Bagnères-de-Bigorre is also a favourite climatic resort.

Capvern (France, Hautes-Pyrénées) is a pleasantly situated resort (1,550 feet), with a station on the railway from Toulouse to Bayonne. It possesses weakly mineralised earthy waters (total solids about 1·6 per mille), containing about 1 per mille sulphate of calcium (temperature 70° to 76° F.).

Siradan (France, Hautes-Pyrénées) lies at an altitude of 1,470 feet at the entrance of a valley, about 12 miles from Bagnères-de-Luchon. It possesses cold earthy springs (1·3 per mille sulphate of calcium), and cold weak chalybeate waters.

Audinac (France, Department of Ariège) lies at an altitude of about 1,470 feet, in a pleasant valley at the foot of the Pyrenees, and is about 3 miles by road from the railway station of Saint-Girons. The waters have a temperature of about 70° F., contain about 1·2 per mille sulphate of calcium, and are slightly ferruginous.

Aulus (France, Department of Ariège) is situated at an altitude of 2,550 feet, in a picturesque valley of the Pyrenees, 20 miles south of Saint-Girons, the nearest railway station. It possesses cold or subthermal calcium sulphate waters, chiefly used internally.

Cransac (France, Department of Aveyron) is a village with a station on the railway between Rodez and Capdenac; it lies (altitude 980 feet) at the foot of the not quite extinct volcano of Le Montet. Cransac possesses cold earthy waters which contain, in addition to sulphate of calcium and sulphate of magnesium, a certain amount of the sulphates of potassium, aluminium, iron, and manganese. The 'Source Basse Richard' contains about 2 per mille each of the sulphates of magnesium, of calcium, and of aluminium.

In the mountain sides are crevices, which are used as natural vapour baths (temperature 90° to 118° F.) for chronic rheumatic cases; the moist air in them contains some sulphuretted hydrogen, as in the 'Stufe di San Germano,' in Italy.

Pougues-les-Eaux (France, Department of Nièvre) lies at an altitude of 650 feet, about 2 miles from the banks of the Loire, and 7 miles distant from Nevers. It possesses cold, gaseous, alkaline earthy waters (1·7 per mille of bicarbonate of calcium, 0·4 bicarbonate of magnesium, 0·7 bicarbonate of sodium, with much free carbonic acid, in the Saint-Léger spring), which are serviceable in 'hypopeptic' and atonic cases of dyspepsia, and in many chronic intestinal disorders, including some cases of chronic diarrhoea; also in gouty conditions and uric acid

sand in weak persons. The waters of Pougues (at least the Saint-Léger spring, the only one formerly in use) have a very old reputation, the spa having been visited by the French kings Henri II., Henri III. and Henri IV.¹ There is now good accommodation, and the small thermal establishment is situated with the Casino in a pleasant park. Pougues has a railway station on the line from Paris to Nevers.

Vittel (altitude 1,100 feet) and **Martigny-les-Bains** (altitude 1,200 feet), in Department Vosges, are stations on the railway, 4 and 6 miles respectively to the north-east and south-west of Contrexéville. They possess cold earthy springs, resembling those of the latter spa, and used for similar classes of affections. Their position and climate likewise resemble those of Contrexéville. The seasons are from about the end of May to about the third week in September. Martigny has likewise a weakly mineralised alkaline earthy spring (total solids 1·4 per mille), called 'La Savonneuse,' which may be employed externally (artificially heated) in the form of baths and douches for cutaneous complications of the disorders for which patients need the ordinary mineral water internally. Vittel is a growing spa with modern bathing facilities and golf links. The 'Source Salée' of Vittel contains 0·3 per mille calcium carbonate, 1·4 calcium sulphate, 0·8 magnesium sulphate (total solids 2·6 per mille). The 'Grande Source' contains about 0·4 per mille each of the sulphates of calcium, magnesium and sodium (total solids, only 1·7 per mille).

Other French waters somewhat analogous to the waters of Contrexéville are those of SAINT-VALLIER, HEUCHELOUP, NORROY-SUR-VAIR, and REMONCOURT, all in the Department of Vosges, and the waters of the SOURCE MAYNARD and LARIVIÈRE-SOUS-AIGREMONT, in Department Haute-Marne, near Bourbonne-les-Bains (*q.v.*).

The following French cold or tepid sulphate of calcium waters have not yet been mentioned: ENCAUSSE (1·7 per mille) and BARBAZAN (1·5 per mille), in Department Haute-Garonne. LE MONÉTIER-DE-BRIANÇON (Department Hautes-Alpes) has waters with a temperature of 71°–113° F. containing 0·5 to 1·5 per mille sulphate of calcium.

San Pellegrino (Italy, Lombardy), 14 miles from Bergamo (with which, and with Milan, it is connected by electric railway), and about 1,150 feet above sea-level, has a subthermal (temperature 80·6° F.) alkaline earthy, weakly mineralised water.

¹ J. Janicot says that it was at Pougues that Jean Pidoux, according to his book published in 1598, originated the employment of cold douches in France. See also Paul Rodet, *Les Médecins à Pougues* (Paris, 1887).

According to Menozzi's examination of 1905 the specific gravity of the water is 1.0009, the depression of the freezing point 0.041° C., and the solid residue at boiling point 1.3 per mille; the water has been found to be free from microbes. Internally it is employed, like that of Contrexéville, in many chronic affections of the bladder and urinary organs, in uric acid gravel, &c. There are likewise arrangements for thermal baths and douches and for ordinary hydrotherapy. The hotel accommodation is satisfactory. The chief season is from the middle of June to the middle of September.

Bagni-di-Lucca (Italy, in the Province of Lucca).—The spa (altitude 400–1,000 feet) is situated at the foot of the Apennines, in the beautiful Valley of the Lima, 15 miles north of the town of Lucca. Three villages help to make up the spa, namely Ponte-a-Serraglio, Bagni-Caldi (1,000 feet above sea-level), and Villa; of which the two latter are most frequented by English visitors.

The baths of Lucca have been known from an early period. The Emperor Frederick II. paid them a visit in 1245. Fallopius and the physician Biancello spoke in praise of them, and in 1581 Montaigne sought aid there. In more modern times they have been visited by Byron, Shelley, and Heine.

The thermal calcium sulphate springs (total solids 2 to 3 per mille) of Bagni-di-Lucca vary in temperature from 98° to 129° F. The hottest and most famous is that of Bagni-Caldi, with 1.75 per mille calcium sulphate and 0.75 per mille sodium sulphate. Here is likewise the chief bath establishment, with a grotto used as a natural vapour bath. The Aix douche-massage and other douches, and massage, and mud baths can likewise be had at Bagni-Caldi.

The thermal baths of Lucca are used in gouty and rheumatic affections, rheumatoid arthritis, and other cases amenable to simple thermal and thermal earthy baths. The bath establishments are open from May 1 to September 15, but the chief season is during June and September, when the place is much resorted to by the inhabitants of Florence. Many of the visitors come merely for amusement and change of air. It can be reached by the new railway in about 1 hour from Lucca or 2 hours from Viareggio.

Chianciano (Central Italy, Province of Siena, not far from Montepulciano) lies in the Valley of Chiana, at an altitude of about 1,800 feet. It is reached from the railway station of Asciano by half an hour's drive, or from the station of Chiusi, and possesses thermal earthy waters. Of the two principal springs, the Sorgente del Bagno Sant' Agnese (102.5° F.) has a total of

3·7 solid constituents per mille (chiefly sulphate and carbonate of calcium) and gives off sulphuretted hydrogen and carbonic acid gas; it is chiefly used for baths. The 'Acqua Santa' (82·4° F.) contains 3·2 solids per mille (sulphate and carbonate of calcium, with minute quantities of the sulphates of magnesium and sodium) and has a diuretic and slight purgative action when taken internally.

Besides the foregoing there are several other Italian earthy mineral springs, now comparatively little known, but some of them celebrated in ancient times.

Alanje (Spain, Province of Badajoz) is situated near Merida at an elevation of about 980 feet above sea-level. Its gaseous earthy waters (83° F.) have a reputation in Spain for functional nervous affections.

Alhama-de-Murcia (Spain, Province of Murcia) possesses hot sulphate of calcium waters (108° F.), employed for chronic rheumatic affections &c.

Kislovodsk (Russia) is a small town situated at an altitude of 2,700 feet in the Caucasus, 14 miles to the south-east of Essentuki (*q.v.*). It is a climatic health resort open throughout the year; according to Dr. F. G. Clemow there are said to be a large number of fine sunny days in winter, though snows and fogs must be occasionally expected; the average temperature during the three winter months is below the freezing point, but in the sun the thermometer may rise to 55° or 60° F. during the middle of the day. Some Russian physicians send phthisical cases to this place. Its chief mineral water is the cold weakly mineralised alkaline earthy Narsan spring, which, according to Zaleski's analysis, contains a total solids of only 1·7 per mille (0·8 calcium carbonate).

CHAPTER XXVII

SIMPLE GASEOUS WATERS, TABLE WATERS, AND VERY
WEAKLY MINERALISED COLD WATERS¹

'TABLE waters' are feebly mineralised waters, usually containing a large quantity of free carbonic acid gas, and may therefore likewise be termed 'simple gaseous' or 'simple acidulated waters' (in German, 'Einfache Säuerlinge'), or, when none of the gas has been artificially added,¹ they may be called 'natural simple aerated waters.' On opening a bottle of water to which the CO₂ has been artificially added, the gas is supposed to escape relatively quicker and in larger bubbles than it does in the case of naturally gaseous waters.

These waters may be of some use in medicine. They mostly contain minute quantities of bicarbonate of sodium, or of bicarbonate of calcium, or of both bicarbonates, and these may, in association with the carbonic acid gas, exercise a favourable effect in dyspeptic conditions. The carbonic acid gas in table waters stimulates the nerves and musculature of the stomach; in moderate quantities it aids digestion, promotes peristalsis, and relieves dyspeptic feelings; it probably also exerts some diuretic influence and tends to increase the flow of bile. A. Bickel's remarkable experiments, already alluded to in the introductory portion of Chapter XVIII, confirm the view that carbonic acid gas in mineral waters tends to increase rather than diminish the specific secretory activity of the stomach.

Such waters, however, are more frequently used for ordinary drinking at meals, or for refreshing draughts between meal-times, than for strictly medical purposes. Needless to say, iron salts in

¹ The French Government does not allow the addition of CO₂ to mineral waters without special permission. It may be noted, however, that the addition of CO₂ to mineral waters, if naturally poor in gas, may undoubtedly help to preserve them. In this connection the following remarks of Joseph Priestley are interesting. In his *Experiments and Observations on Different Kinds of Air* (Birmingham, 1790, vol. i. p. 51) he wrote: 'I do not doubt, therefore, but that by the help of a condensing engine, water might be much more highly impregnated with the virtues of the Pyrmont spring; and it would not be difficult to contrive a method of doing it.'

any considerable quantity and much bicarbonate of sodium mix badly with wines, especially with red wines. The amount of solids contained in table waters should not be sufficient to give them any strong taste; and the carbonic acid gas present (sometimes additional CO_2 is added before bottling) should be sufficient to prevent the precipitation of the mineral constituents and enable the water to 'keep well.' Much, however, of the temporary popular preference for particular 'table waters' over others depends on mere fashion and advertisement.

One of the great advantages which these waters have over many of the ordinary manufactured aerated waters is that the perfect purity of the water may be almost certainly relied on¹—an inestimable advantage when there is reason to suspect that the ordinary drinking water of a town may be contaminated. The constant use² of large quantities of highly gaseous table waters, whether natural or artificial, is, however, a habit not to be recommended.

Most of these waters are well known by advertisements, and as most of them have comparatively little to do with ordinary spa-treatment, it will be sufficient here to enumerate them. They can be roughly divided into three classes, according as their mineral constituents show them to be weakly mineralised members of (1) the simple alkaline group of mineral waters, (2) the muriated alkaline group, or (3) the earthy group. The third class includes the alkaline earthy table waters, and those which, though they contain bicarbonate of sodium, contain as much or more

¹ The same can, however, be said for those artificial table waters in the manufacture of which (Salutaris water, Globenaris water, &c.) distilled water only is used (see, however, remarks in Chapter XII on a possible disadvantage of the use of distilled water), or water which has been filtered through properly kept Pasteur-Chamberland, Berkefeld, or other reliable filters.

² The use of aerated waters in some persons tends to keep up laxity of the motions. In cases of 'morning diarrhoea,' according to Lauder Brunton ('On Some Forms of Diarrhoea, especially Morning Diarrhoea,' *Quarterly Medical Journal*, January 1894), any aerated water either with or without alcohol, taken during the evening, has an especial tendency to keep up this troublesome complaint.

Some patients when taking a course of laxative waters must apparently abstain from taking aerated table waters during the course, on account of the motions becoming too fluid or frequent when both waters are being taken. Gaseous waters have also been held responsible for symptoms due to disturbances in the cerebral circulation.

In regard to the use and abuse of simple gaseous waters Leonard Williams's indictment (*Lancet*, 1906, vol. i. p. 1568) of the habitual use of aerated drinks should be referred to. According to him not only do gaseous waters favour the consumption of spirits, but, owing to the stimulating effect of the carbonic acid gas on the gastric mucosa, they promote over-alimentation, and, owing to the distension which they cause, they aid in producing gastric dilatation with associated cardio-vascular troubles; whilst the absorption of the gas, like the over-alimentation, adds to the work of oxygenation.

bicarbonate of calcium (i.e. belonging to the French group, 'Eaux bicarbonatées mixtes').

In the first group may be placed: APOLLINARIS,¹ near Neuenahr, the JOHANNIS² spring at Zollhaus, GEROLSTEIN, BIRRESBORN, all in Rhenish Prussia; OBERLAHNSTEIN, near Ems; GEILNAU, on the Lahn; TEINACH (the Hirschquelle), in Würtemberg; SULZMATT (French, SOULTZMATT), in Alsace; GIESSHUEBL, KRONDORF, KLÖSTERLE, near Karlsbad, in Bohemia; PREBLAU (Chapter XIX); ADONIS water, in Belgium. In France we have: TEISSIÈRES-LES-BOULIÈS (Department Cantal), BUSSANG (containing appreciable amounts of iron, manganese, and arsenic, Chapter XXIV), COUZAN or SAIL-SOUS-COUZAN, and the most weakly mineralised of the Vals springs (such as the Pauline, Délicieuse No. 1, Saint Jean and Impératrice, see Chapter XIX). Of these waters, Birresborn contains as much as 2·8 per mille bicarbonate of sodium, and is therefore rather strongly alkaline for an ordinary 'table water.' Bilin (3·3 per mille) and Fachingen (3·5 per mille) contain too much bicarbonate of sodium to be classed as 'table waters.'

In the second group may be placed ROISDORF, TOENNISTEIN (sold in England as ABROLIS water), NIEDERMENDIG (REGINARIS water), and RHENS,³ in Rhenish Prussia; ROSBACH, near Homburg, the KRONTHALBRUNNEN and the WILHELMSQUELLE at KRONTHAL,⁴ and SELTERS⁵ (Niederselters, the real natural 'Seltzer' water), all in the Prussian Province of Hesse-Nassau; the CAMBRUNNEN table water, said to be bottled at springs near Homburg; SCHWALHEIM and LUDWIGSBRUNNEN, near Nauheim (*q.v.*); the Germania-Brunnen (FORTUNA mineral water) at DORHEIM, near Frankfurt-a-Main; the TAUNUSQUELLE, the LUDWIGSBRUNNEN and the SELZERBRUNNEN, near GROSSKARBEN, in the Grand-Duchy of Hesse; the HARZER SAUERBRUNN of GRAUHOFF, near Goslar; the EYACH-SPRUDEL, in Würtemberg, near Stuttgart; and the ACQUA ACETOSA, near Rome, which is very popular with

¹ The water from the spring is collected into tanks, about 1 per mille common salt is added, and a precipitate of peroxide of iron separates out. Some of the free carbonic acid gas escapes during this process, but fresh gas is added before bottling.

² Johannis water can likewise be obtained containing a small artificial admixture of bicarbonate of potassium or bicarbonate of lithium. Thus slightly modified the water is sold as 'Johannis potash water' or 'Johannis lithia water.'

³ The Rhens water differs from most other table waters in containing about 0·8 per mille sodium sulphate.

⁴ Three sorts of Kronthal table water, differing from each other in the amount of mineralisation, can be obtained in London.

⁵ Selters water contains about 2 per mille common salt, 1 per mille sodium bicarbonate, $\frac{1}{2}$ per mille calcium bicarbonate, and $\frac{1}{4}$ per mille magnesium bicarbonate. The 'Karlsprudel' at BISKIRCHEN, in the neighbourhood, a gaseous muriated alkaline spring, the profits from which are devoted to a charitable purpose, contains 2·5 common salt, 0·3 sodium bicarbonate, 1·8 calcium bicarbonate, 0·8 magnesium bicarbonate.

the Romans during spring and summer, at which seasons the water is daily brought fresh from the spring, and sold in the streets of the city.

The third group includes the following: BELLTHAL, in Rhenish Prussia; the spring of GOEPPINGEN, in Würtemberg, mentioned by Paracelsus; ROEMERQUELLE IN CARINTHIA; SAUERBRUNN (PECSENYED), in Hungary, near Wiener-Neustadt; the SALVATOR water of SZINYE-LIPOCZ (see Chapter XIX); and the following French waters: CONDILLAC, BONDONNEAU, ORIOL, CHÂTELDON, SAINT-GALMIER¹ (which may likewise be obtained charged with additional CO₂), RENAISSON, FOURCHAMBAULT, SAINT-ALBAN, and some VERGÈZE springs (including the water exported as PERRIER water); also SANGEMINI, near Terni, in Italy.

The water of EVIAN, unlike most table waters, is very poor in gas, and may be considered a very pure ordinary water, like the similar waters of THONON (six miles from Evian), and those of ROMANEL (near Lausanne), AIGLE-LES-BAINS, and HENRIEZ-LES-BAINS, in Switzerland, like the DEUX-REINES, MASSONAT, and SAINT-SIMON waters, near Aix-les-Bains (see Chapter XXV), and also like ALET water (Chapter XVII) and the Source CRISTAL-CHÂTEAU, both obtainable as table waters in Paris. In England the natural MALVERN water (still or aerated) on account of its known purity and freedom from excess of calcium carbonate is useful in the same way as Evian water and distilled water are. The 'RENINE' water ('Eau Nitrée d'Alsace') from the Cæsar spring of REIPERTSWILER, in Alsace, contains, according to the analyses by E. Willm (1880) and by W. J. Dibdin, about 0.13 per mille of potassium nitrate.

Without repeating all that we have already stated in Chapters XIII and XIV regarding possible physiological effects of radio-activity in mineral waters, we may here mention that slight amounts of radio-activity have been demonstrated not only in various simple thermal waters and waters ordinarily spoken of as 'mineral waters,' but likewise in cold springs and 'tap-water' used for ordinary drinking purposes (J. J. Thomson, F. Dienert,² &c.).³

¹ Saint-Galmier (altitude 1,300 feet) near Montbrison, in the Department of Loire, possesses many springs, but the 'Source Badoit' seems to be the one mainly exported.

² Académie des Sciences, Paris, April 1906. Dienert examined various springs used for drinking water in the City of Paris, and found that they possessed radio-activity (he obtained no evidence of the presence of actual radium in any of them).

³ Cf. P. Bergell and A. Bickel, *Zeitschrift für klin. Medizin*, Berlin, 1906, vol. lviii. p. 235. Strutt (*Proc. Roy. Soc.*, London, 1906, Series A, vol. 78, p. 151), who has examined tap-water and boiler crust from Cambridge, finds the deposit from the thermal springs of Bath 100 times as rich in radium as any rock, whereas sea-salt and deposits from ordinary cold water are much poorer in radium than any of the rocks.

Many spas, described in other chapters, besides their better known, more active mineral springs, possess also weakly mineralised gaseous waters, which are or could be employed as simple table waters. Amongst these are those already mentioned near Nauheim; the Dorotheenquelle at Karlsbad, in Bohemia; the Lindenquelle at Langenschwalbach; the Christiansbrunnen at Liebwerta; the Sinnbergerquelle at Brückenau; the Theophilquelle at Passugg; LA VERNIÈRE spring near Lamalou (*q.v.*); the SAINT-PARDOUX spring near Bourbon-L'Archambault (*q.v.*), &c.

Many waters used as table waters contain small amounts of iron, sometimes more than is advisable for ordinary table use: thus Saint-Alban (Puits César) and Châteldon (Puits Rond) have over 0.02 per mille of the bicarbonate of iron, and Oriol (near Grenoble), according to O. Henry, has 0.04 per mille. Some table waters are sufficiently mineralised to be mentioned separately in other groups; thus, Birresborn, Toennistein, and Preblau are mentioned likewise amongst the simple alkaline waters. In some cases arrangements for the accommodation of visitors, with bath establishments, &c., exist at very weakly mineralised (gaseous or non-gaseous) springs, as notably at Evian-les-Bains, and these we must therefore mention separately as spas.

Giesshuebl-Puchstein or Giesshuebl-Sauerbrunn (Bohemia) is pleasantly situated in the valley of the Eger, on both banks of the stream, about 6 miles distant from Karlsbad. There is a bath establishment with facilities for hydrotherapy &c., but its mineral water is chiefly exported for use as a gaseous table water.

Sauerbrunn (Pecsenyed), in Hungary (Oedenburg Comitatus), close to the Austrian boundary and only $5\frac{1}{2}$ miles from Wiener-Neustadt, possesses a weak alkaline-earthy gaseous water which is exported as a table water. There are facilities at Sauerbrunn for hydrotherapy &c.

Schmecks, or Tatra-Füred (Hungary, Zips), consists of three neighbouring localities in the Carpathian Alps, on the southern declivity of the High Tatra: ALT-SCHMECKS (altitude 3,320 feet), NEU-SCHMECKS (3,300 feet), and UNTER-SCHMECKS (3,080 feet). They possess gaseous springs used for table waters and effervescent baths; also arrangements for ferruginous moor baths and hydrotherapeutic treatment. At Neu-Schmecks there is a sanatorium for phthisical patients, open throughout the year. (See also Part I, Chapter IX.)

Zaizon (Transylvania, altitude 2,590 feet), a spa visited chiefly by women and children, contains the weak gaseous muriated alkaline 'Ferdinand's spring' (1.3 bicarbonate of sodium, 0.6 common salt) which was said to contain as much as 0.249 per mille iodide of sodium. There are also weak chalybeate waters.

Füred (Balaton-Füred), a popular summer resort in Hungary, at an altitude of 425 feet, is beautifully situated on the PLATTENSEE or BALATON LAKE, the largest lake in Hungary, 1 hour by steamer from the railway station of Sio-Fok. Its cold gaseous weakly mineralised springs might, according to the analysis of the Franz-Josefs-Quelle, to which we shall refer, be classed in the sulphated alkaline, in the earthy, or in the chalybeate group, but, considering their probable mode of action, are preferably placed in the present group, amongst the simple gaseous waters. The Franz-Josefs-Quelle, in the Kurplatz, is the favourite well used for drinking; according to Heller's analysis it contains about 0.8 per mille each of carbonate of calcium and sulphate of sodium, 0.11 per mille of carbonate of sodium, 0.01 per mille of carbonate of iron, and 1,207 per mille volumes of free carbonic acid gas. Bathing in the lake is much adopted as a means of treatment. Its water (temperature as high as 68° to 80.6° F. during summer) contains 54 volumes per mille free carbonic acid gas and likewise in its other constituents differs from ordinary water. It seems as if gaseous springs arose in the bed of the lake and as if the whole lake might be regarded as a vast reservoir of diluted mineral water. The mud from the banks of the lake is used for mud baths, often in combination with massage. Füred is also a suitable resort for whey and grape cures. The mean temperature of the air is (according to Chyzer) for May 52.9° F., for June 68.2°, for July 71.6°, for August 67.1°, for September 66.2°; during these five months on the average there are 48 rainy days. The season lasts from the middle of May to the middle of September.

Fideris (in Switzerland, Grisons) must likewise be mentioned in this place. The establishment lies at an elevation of 3,580 feet in the Praetigau Valley, and its cold gaseous waters contain only very little iron (0.01 per mille of the bicarbonate) and a total of under 2 per mille solids. (See also Chapter XXIII.)

Roemerquelle, in Carinthia, has a well-wooded situation at the foot of the Ursulaberg, 1,670 feet above sea-level. The simple gaseous spring has a total of 1.47 solids per mille. The establishment can be reached by an hour's drive from the railway station of Prevali.

Fuscherbad, or **St. Wolfgang's Bad** (Austria, Styria), lies at an altitude of about 4,040 feet in a sheltered side valley of the beautiful Fuscherthal. The springs, known from the fifteenth century, appear to be ordinary very pure water. Fusch is a suitable mountain climatic station in many cases, and is sometimes visited by patients after a course of thermal baths at Gastein. The nearest railway station is Bruck, about 2 hours distant.

Evian-les-Bains (France, Savoy) is situated on the Lake of Geneva, opposite Lausanne, at an altitude of 1,240 feet. Its name (Evian=Aquianum) is doubtless connected with its springs. The cold alkaline waters are so feebly mineralised that they resemble simple very pure waters. According to the analysis made by E. Willm in 1894, the Source Cachat, which may be taken as the type of the Evian springs, has a total solids of 0·3 per mille, chiefly calcium carbonate (0·19 per mille). Like simple water, the waters of the Evian springs exert a diuretic action; according to the experiments of Corre and Bergouignan, however, the diuretic effect of Evian water (Source Cachat) is decidedly greater than that of an equal quantity of simple pure (distilled) water. The Evian springs have a reputation for affections of the urinary organs and the uric acid diathesis; for early symptoms of arteriosclerosis (before dilatation of the heart and failure of the circulation occur); for gastralgia in gouty subjects, nervous dyspepsia, &c. They are used chiefly for drinking, but also for bathing, and there are likewise arrangements for hydrotherapeutic treatment, the Aix douche-massage, ordinary massage, Swedish gymnastics, various forms of electrotherapy, electric light baths, &c. It appears, according to the observations of Chiaïis, quoted by Bergouignan, that all the satisfactory effects of a course of Evian water may be obtained by taking only 300–500 c.c. instead of, according to old-fashioned customs, three or four litres daily. The season is from June to the commencement of October. In the case of anæmic and cachectic patients the neighbouring weak chalybeate water of AMPHION-LES-BAINS is sometimes used. Amphion is about 1 mile to the west of Evian, and possesses also waters analogous to those of Evian.

Thonon (France, Haute-Savoie) has cold weakly mineralised waters, similar to those of Evian-les-Bains. The town lies on the southern shore of the Lake of Geneva, 6 miles to the west of Evian, but on a cliff about 130 feet above the lake.

Fiuggi, near **Anticoli-di-Campagna** (2,620 feet above sea-level), in South Italy. Fiuggi is the name of a cold weakly mineralised spring (total solids only 0·058 per mille), which has a diuretic action and an old reputation in cases of uric acid gravel &c. It should be compared to Evian water rather than to any of the Vichy springs. The water fresh from the Fiuggi spring has been recently shown to possess decided radio-active properties.

With the springs of Fusch, Evian, Thonon, Aigle &c. may be classed the cold weakly mineralised springs of Malvern and Ilkley, in England, and other simply pure water springs much employed in former times for their supposed special therapeutic effects, but in modern times used either for their purity or on ordinary hydro-

therapeutic principles, sometimes in connection with special establishments. Some of the Spanish springs (of cold to sub-thermal temperatures) employed internally for dyspeptic troubles &c. might be placed in this group; for instance, the waters of SOBROU (70° F.), in the Province of Alava, which Labat classes with Evian rather than with Vichy. Sobrou is situated in a beautiful valley at an altitude of 1,475 feet above sea-level. A great number of cold weakly mineralised springs, having a therapeutic reputation, exist in different parts of Europe. Some of them are classed as weakly mineralised earthy waters; others contain so much free carbonic acid gas that they belong to the simple gaseous group; others again, though they contain only minute quantities of the bicarbonate of iron, sometimes considerably below 0.01 per mille, are yet classed as chalybeate waters.

One finds the cold waters of EMPFING (or WILDBAD-EMPFING) and of ADELHOLZEN (or WILDBAD-ADELHOLZEN) in Upper Bavaria, with a total mineralisation of under one-half per mille, still classed in the alkaline earthy group, and so also the cold waters of BAD REHBURG, in Hanover, with a total mineralisation of about 1 per mille.¹

There are also cold weakly mineralised springs with or without much free carbonic acid gas, containing a minute quantity of some special constituent, for which a particular therapeutic effect has been claimed, and these springs we shall group together here for convenience. Such are the springs of Saint-Christau, containing a minute quantity of sulphate of copper, the 'phosphatic waters' of Aiguemont, and the 'iodine-springs' of Krankenheil, one of the larger health resorts of Bavaria.

Krankenheil-Tölz (Upper Bavaria).—Krankenheil is beautifully situated on the northern slope of the Blomberg, at an elevation of 2,150 feet above the sea. It is separated from Tölz by the Isar. Its cold weakly mineralised waters may be fairly mentioned in this place, though on account of the employment of the concentrated waters &c. for baths they would perhaps from the therapeutic point of view be more conveniently classed with the muriated springs. They contain 0.2 to 0.4 per mille bicarbonate of sodium, 0.03 to 0.29 per mille chloride of sodium, about 0.001 per mille iodide of sodium, and a little sulphuretted hydrogen gas. Salts derived from the Krankenheil waters, soaps made with the salts, and the concentrated mineral waters, are all made use of in the treatment of patients. This health resort is

¹ Bad Rehbürg (see Part I, Chapter IX) is now chiefly known as a climatic resort with special sanatoria for pulmonary tuberculosis. Empfing (1,870 feet) and Adelhöhlen (2,100 feet) are summer resorts near Traunstein (see Part I, Chapter IX), in Upper Bavaria. Their weakly mineralised waters can be artificially impregnated with carbonic acid gas for use as 'table waters.'

much frequented and has a reputation in scrofulous affections, chronic endometritis, skin eruptions, &c. The season lasts from May 15 to October 1.

Coise (France, Savoie), 2 miles from the railway station of Cruet, has the 'Fontaine de la Saulce,' whose weakly mineralised alkaline waters, with a total mineralisation of 0·9 per mille, contain 0·007 iodide of magnesium and 0·001 bromide of magnesium. The water has an old local reputation against goitre.

Saint-Christau (France, Department of Basses-Pyrénées), a small resort at the entrance of the narrow Pyrenean Valley of Aspe, is about 1,000 feet above sea-level and about 5 miles distant from the railway station of Oloron. It possesses feebly mineralised cold earthy waters (total solids 0·2 to 0·5 per mille). According to Willm (1882) the 'Source des Arceaux' contains 0·001 per mille of carbonate of iron and manganese and 0·0003 per mille of sulphate of copper. There is likewise a tepid spring (about 79° F.), which after having been lost for many years has now been rediscovered and properly enclosed; it is said to contain more copper than the cold springs. The waters of Saint-Christau, besides being used for drinking, bathing, various douches, and irrigations for the mouth and nose, are employed as a finely pulverised spray for chronic laryngitis and pharyngitis, for the eyes in chronic blepharitis and conjunctivitis, and likewise for the ears. It is in fact the pulverisation treatment which is the special feature of the spa. According to local authorities great success is claimed in certain chronic affections of the tongue and buccal mucous membrane, including chronic glossitis of smokers.

The establishment, owing to the sheltered position of the site and the mild character of the climate, can be kept open all the year round. During hot weather the fine park affords shelter from the sun. There are many beautiful Pyrenean localities to which excursions can be made from Saint-Christau. The accommodation and general arrangements have been improved.

Aiguemont (France, Seine-et-Oise) has a cold weakly mineralised water, which, according to the 1887 analysis, contains 0·179 per mille calcium phosphate, 0·2 calcium bicarbonate, 0·04 calcium nitrate; it has a total of only 0·6 solids per mille, and a moderate amount (86 volumes per mille) of free carbonic acid gas. Some importance has been claimed for this water, on account of its phosphatic contents, in scrofulous and rachitic conditions of children. It has likewise been recommended for use at meals as a 'table water.'

CHAPTER XXVIII

LOCALITIES FOR AN AFTER-CURE TO SPA-TREATMENT

THE nature and situation of the climatic health resort to be selected for rest ('after-cure,' 'Nachkur') after the various courses of waters is not without importance; but it is difficult to lay down general rules, as every case must be considered according to its individual nature and the accompanying circumstances. Courses of the more active waters usually ought to be followed by a longer rest than courses of the less active waters; but in the patients themselves there are great differences, which must guide the medical man in deciding the length of the after-cure to be recommended, and the particular health resort to be selected. Some patients are so weak at the commencement of the treatment that even after a very slight course of waters a long rest is necessary, and the locality selected must not be too distant from the spa.

Localities of Considerable Elevation.—Although the elevation of a place above sea-level is an important point, there are many other considerations almost equally so; for instance: whether a locality lies on the south or on the north side of a mountain range or on the top; whether it is sheltered from cold winds or exposed to them; whether the air is habitually still or agitated; whether the soil is dry or damp; whether there are forests in the immediate neighbourhood, and whether these consist of pines or deciduous trees; whether the water is pure and abundant, whether it is hard or soft; whether the air is habitually clear or dull from clouds, or often misty; whether the air is free from dust, or exposed to the latter; owing to the neighbourhood of chalky roads; whether the air is aseptic, or is impure from the nearness of large towns, manufactories, or marshes. It is further in most cases necessary to consider whether the accommodation is good and hygienic; whether the food supply and the cooking are satisfactory; what are the means of access, by rail or by a good carriage road, by a long or short drive, or whether only by a mule path; whether many excursions can be made in the neighbourhood, and whether they are practicable for carriages or

only for mules or donkeys or only on foot ; whether there is an opportunity for level walking, or whether all is up-hill or down-hill ; also what is the nature of the society, whether the life is simple or the opposite ; whether there is much or little social amusement, music, dancing, games ; whether there is opportunity for boating, fishing, or shooting. We need scarcely mention again, that it is most important to know whether good medical advice can be had.

Long as this list of considerations is, it might easily be further enlarged. The physician who prescribes health resorts for an after-cure ought to be acquainted with the nature of the locality recommended, if possible by personal visits and the reports of thoroughly judicious people.

There are, however, some points about which we cannot be always certain. Thus the hygienic arrangements may suddenly get out of order ; an epidemic disease may be introduced ; the cook, or manager, or head waiter may be changed ; the financial means may be lacking, and a usually suitable place may become altogether unsatisfactory for a longer or shorter period.

If we have to deal with patients possessing a soundly acting heart and healthy blood-vessels, and who are free from any other serious organic disease, we need not fear a somewhat long journey, and may recommend bracing localities of considerable elevation (from 3,500 to 7,000 feet) even in the absence of level walks. We must, however, keep in mind that there are certain persons who, though apparently free from any organic disease, do not bear high elevations, who become excited, lose appetite and weight, become sleepless and breathless, at higher elevations. They are principally persons of a so-called nervous type. To such persons we must not recommend high elevations.

With the exception of this class of cases, most of the high altitude localities (from 3,500 feet upwards) mentioned in Part I are suitable as far as the climate *per se* goes. As, however, the mental condition is always extremely important, we shall do well in recommending to those who become unhappy without amusement localities where social entertainment can be had. The health resorts in the Upper Engadine not only possess good hotels visited by many interesting people, but also good carriage roads, allowing fine drives in several directions. The Engadine is in this respect unequalled by any other district in Europe. Good hotels and beautiful scenery and agreeable society are to be found also at some other high altitude resorts, in Tyrol or in Switzerland, but there is not quite the same facility for carriage drives. We may mention Sulden and Trafoi, in the Ortler district ; the Karersee Hotel, between Botzen and the Fassa

Valley, and Vigo-di-Fassa, the chief village of the Fassa Valley ; the Hôtel Dürrenstein, near the Pusterthal. The Val d'Ampezzo and its neighbourhood offer several very attractive localities, such as Schluderbach, the Grand Hotel at the Lago Misurina, Cortina-di-Ampezzo with several good hotels, and, not far off, the Hôtel Miramonte at Pezzie. Another suitable place in the Dolomite district is San-Martino-di-Castrozza, beautifully situated on a southern mountain slope. The Brennerbad and Gossensass, on the Brenner railway, likewise offer good accommodation and facilities for excursions. In Switzerland we have, in addition to the Engadine resorts already mentioned : the Davos Valley and Arosa, in Canton Grisons ; the Belalp, the Eggishorn, the Rieder Furka, the Rieder Alp, Saas Fée, the Riffel Alp and Zermatt, Chandolin, Montana, and Caux, in Valais ; Mürren, Wengen, and Gurnigel, in the Bernese Oberland ; Rigi-Scheidegg, Rigi-Kaltbad, and Rigi-First on the Rigi.

To those who are satisfied with either quieter hotels or less English society, most of the other high altitude health resorts mentioned would be acceptable.

Localities of Moderate Elevation.—If the patient's heart is dilated and feeble, high altitudes and the absence of level ground must be avoided, whilst slight and moderate elevations (600 feet to 3,500 feet), with the opportunity of exercise on level or only gently rising ground, are preferable to low inland situations or the seaside. Amongst many such health resorts are the following : in the Black Forest—Badenweiler, Rippoldsau, Griesbach, Peterthal, Freudenstadt, Titisee, St. Blasien, Todtmoos, Wildbad, Herrenalb, and Teinach ; in the Thuringian Forest—Friedrichroda, Tabarz, Liebenstein, Ruhla, Oberhof, Ilmenau, Elgersburg, &c. ; in the Harz Mountains—Schierke, Harzburg, Wernigerode, Ilsenburg, Gernrode, Alexisbad, Blankenburg, Ballenstedt, Clausthal, Andreasberg ; in the Vosges Mountains—Altenberg (near the Schlucht), Hohwald, Odilienberg, Altweier, Drei Aehren, Gérardmer ; in the Fichtelgebirge—Alexandersbad, Berneck ; in the Taunus—Koenigstein, Schlangenbad, Schwalbach, and Homburg.

To the north of the Bavarian highlands are some agreeable localities for this class of cases, such as Starnberg and Tegernsee, on the lakes of these names ; the Salzkammergut and neighbourhood contain many useful and charming places : Salzburg, Berchtesgaden, Gmunden, Ischl, Aussee and Alt-Aussee, St. Wolfgang (on St. Wolfgang See), Hallstatt, Zell-am-See ; the central and northern portions of Tyrol (with the adjoining border of Bavaria) are very rich in suitable localities, amongst which we

will mention only Innsbruck, the Achensee, Bruneck, Partenkirchen, Garmisch, and Kainzenbad (the last three in Bavaria).

In Switzerland (and the neighbouring part of France) a number of places of moderate elevation can be used for an after-cure, though not all of them have sufficient level walks for patients with much cardiac weakness. Amongst them we may mention Grindelwald, St. Gervais (village), Chamonix, Argentière, Les Avants and Glion (above Montreux), the Dolder Hotel (above Zürich), Macolin or Magglingen (above Bienne), Engelberg, Bürgenstock, Axenstein, Axenfels, Seelisberg, Seewis, Thusis, Ragatz, Le Prese, and Heiden (see Part I, Chapter VII, for notes on all these places). The list might, however, be considerably extended.

In patients with dilated hearts the differences in the individual power are so great that in some an altitude above 1,200 feet is not well borne, while others feel perfectly well at 3,000 feet or more. In well compensated slight mitral valvular defects high elevations are often quite as well borne as when the heart is perfectly normal.

Localities for Malarial Cases.—When cases of malarial origin have undergone spa-treatment, this treatment should always be followed by a long stay at some locality perfectly free from malaria. Places of high elevation usually exercise a much better effect than localities at low elevations, especially those in close proximity to large glaciers, such as the Belvédère Hotel on the Furka road near the Rhone Glacier, Montanvert, the Belalp, the Rieder-Furka, the Eggishorn, Pontresina, and Arolla.

For Chronic Rheumatic Cases and Rheumatoid Arthritis.—Very important cases are those of chronic rheumatoid arthritis and chronic rheumatism. If the heart in these cases is sound, one rarely need be afraid of a high altitude, though in many of them lower elevations are more satisfactory, but it is essential to select dry and sunny localities. Such localities are: Les Avants, Glion, and Caux, above Montreux; St. Beatenberg, above the Lake of Thun; Gurnigel; Seewis; Pontresina; Maloja; Rigi-First and Rigi-Kaltbad; and the localities on the heights above the Rhone Valley, which have been previously mentioned; also Bormio, Courmayeur, Macugnaga, and Monte-Generoso, to the south of the main Alpine chain. In lower positions, Les Corbières above Aix-les-Bains, Altenberg (in Alsace, on the German side of the Schlucht), Badenweiler, Homburg, Royat, and most of the Pyrenean resorts are suitable.

For many rheumatic cases a long stay at the seaside, after a course of waters, is preferable to a stay at mountain health resorts, owing to the action of the sea air on the skin. Bathing

in the open sea is, however, to be avoided after the use of active spas, such as Karlsbad, Marienbad, Tarasp, Franzensbad, and Kissingen.

In Cases of Emphysema and Bronchitis.—In sufferers from emphysema and chronic bronchitis only moderate altitudes are borne, and it is desirable to select localities without wind and dust, situated if possible within or in the neighbourhood of large forests, pine forests by preference. Such localities are the Flimser Waldhäuser (too high in very advanced cases), Ragatz and Weissenburg, in Switzerland; Alt-Aussce, Kreuth and Achensee, and Zell-am-See, in the Eastern Alps; Schierke and other localities in the Harz Mountains; Badenweiler, Baden-Baden, Wildbad, Teinach, Griesbach, Rippoldsau, &c., in the Black Forest; Hohwald and Gérardmer, in the Vosges Mountains; Alexandersbad, in the Fichtelgebirge; Friedrichroda and Liebenstein, in the Thuringian Forest; Schlangenbad and Koenigstein, in the Taunus; Brückenau, in Lower Franconia.

Localities after a Late Cure.—When courses of waters are taken late in the year, one of the more sheltered localities near the south slopes of the Alps can be selected for the after-cure. Such are Meran and Botzen, in Tyrol; Locarno and Pallanza, on Lago Maggiore; Cadenabbia, Bellaggio, and Menaggio, on the Lake of Como; Lugano: Varese, &c. The same applies to some places on or near the shores of the Swiss Lakes, such as: Ouchy (Lausanne), Vevey and Montreux, on the Lake of Geneva; Lucern, Brunnen and Gersau, on the Lake of Lucern; Interlaken and Thun, near the shore of the Lake of Thun, &c.

Localities in the British Islands.—It is sometimes important that the after-cure be made nearer home, and there are a number of localities in England, Scotland, Wales, and Ireland suitable for residence after spa-treatment, though they have not the high elevation which might be desired for some cases. Many of them find a place in our description of British marine resorts in Part I. Others are included amongst British inland (climatic and mineral water) health resorts: Buxton, Harrogate, Tunbridge Wells, Gilsland Spa, Llandrindod, Llangammarch, Llanwrtyd, Strathpeffer and Bridge-of-Allan, all of which places possess mineral waters; Ilkley, Ben Rhydding, Málvern, Pitlochry, and Crieff, localities where hydrotherapy can also be employed. Suitable localities can be found in various districts in Surrey, Kent, Sussex, and Hampshire, including the neighbourhood of Leith Hill, and the hills near Redhill, Reigate, Dorking, Guildford, Godalming, and Haslemere; the elevated ground extending from Redhill eastward to Westerham and Sevenoaks; and Crowborough. Further from London we have: the neighbourhoods of Clifton,

in Gloucestershire, and of Dartmoor, in Devonshire ; Llanberis (near Snowdon), Llangollen, Lake Vyrnwy Hotel, the Elan Valley Hotel, and other places in Wales ; Braemar, Ballater, Forres, Aviemore &c. in Scotland.

If we were to enter fully into the climatic conditions of the localities to be recommended for different invalids, for a stay after courses of spa-treatment, we should go beyond the sphere of this chapter ; but enough has been said, we hope, to serve for guidance on this rather important matter.

Precautions during the After-Cure.—Whatever locality may be recommended, the invalid must always bear in mind that it is essential for him to spend as much time as possible in the open air, to avoid fatigue, to continue with a strict diet, and to be very careful with regard to dress, so as not to expose himself to chills.

PART III
INDICATIONS FOR TREATMENT

**THE USE AND SELECTION OF
CLIMATES, MINERAL WATERS, AND HEALTH RESORTS
IN CHRONIC DISEASES AND MORBID CONDITIONS,
WITH HINTS AS TO THE EMPLOYMENT
OF VARIOUS PHYSICAL AND DIETETIC METHODS**

CHAPTER XXIX

INTRODUCTORY—ON ASSOCIATED THERAPEUTIC FACTORS IN THE EMPLOYMENT OF CLIMATES, HEALTH RESORTS, AND SANATORIA—GRAPE CURES, MILK CURES, ETC.

It is often very difficult to form an estimate of how much of the benefit derived from Health Resorts is due to climate and mineral waters, and how much to associated influences. At any rate, we wish it to be clearly understood in regard to the health resorts we recommend, that the mere climate or mineral water constitutes only one element in the treatment; we will now shortly allude to various other elements, such as mental rest, cheerful surroundings, muscular exercises, open-air life, altered diet and regimen, hydrotherapy, and other kinds of 'accessory treatment.'¹

Rest and Recreation.—In many conditions, such as insomnia and neurasthenia from overwork and exhaustion due to town life and social strain and worries, rest is an essential part of the treatment and has to be considered in the selection of a health resort. In some hysterical and hypochondriacal conditions, however, a certain routine occupation,² such as is necessary in following out the doctor's prescriptions at health resorts (internal use of mineral waters, baths, hydrotherapeutic measures, &c.) is serviceable. The patient's mind is thus occupied and his

¹ The utilisation of the various physical and psychical methods which come into play in the modern treatment at health resorts and sanatoria carries us back to quite early times. In the time of the great Hippocrates, in the fifth century before the Christian era, invalids seeking relief from their ailments from Asclepius and the physician-priests of his famous temple on the island of Cos were powerfully acted on by change of surroundings and mental suggestion (just as in mediæval and modern pilgrimages to celebrated shrines of the Christian and other still existing religions), and by fresh air in abundance (sleeping in a kind of open-air galleries), muscular exercises, diet (limitation of food and wine, or 'feeding up,' according to the supposed requirements of the case), hydrotherapy (baths and douches), and even the internal use of a chalybeate mineral water. Cf. Dr. R. Caton's lecture at the Royal Institution, March 2nd, 1906.

² In neurotic patients, especially women, a not infrequent difficulty with regard to health resorts and spa-treatment, as indeed with regard to other methods of treatment, is the absence not only of healthy will-power, but likewise of normal aims and objects in life. In such cases ordinary advice may almost be compared to an endeavour to steer a boat, which is without rowers and consequently drifting with the stream, simply by changing the direction of the rudder.

attention diverted from his subjective symptoms. Open-air exercises and games according to individual powers are frequently desirable, as are mental recreations (listening to music in the open air, &c.). The soothing influence of cool green woods in summer weather, and the enjoyment of beautiful scenery, has a beneficial mental effect in many individuals. In regard to the mental factor in visits to health resorts, see also the section on 'Psychical Influences in Spa-Treatment' in Chapter XV.

Exercise and Mechanotherapeutics at Health Resorts.—

We have already considered this subject in Chapter XV. Amongst those who seek relief at health resorts it is only necessary to think of the great class whose indoor sedentary life has helped to induce dyspeptic, nervous, and other ailments, not to mention a host of gouty, plethoric, and obese patients for whom exercise is necessary, to recognise the great part played by judicious open-air exercise in many of the good results obtained at health resorts. In many cases, especially in persons with cardiac weakness, it is important that the exact amount and kind of the daily exercise may be regulated by the doctor, and this can be admirably managed at places situated in broad valleys and surrounded by well-wooded slopes, on which pleasant shady paths have been constructed for level walking and for 'climbing' exercise at various inclinations.

When the late Professor M. J. Oertel, of Munich,¹ directed attention to the value of general climbing exercise ('Terrain-Cur') in the treatment of various chronic cardiac affections, a great impetus was given towards the utilisation of health resorts for this purpose. Suitable health resorts were termed 'Terrain-Curorte' (Meran, Reichenhall, Baden-Baden, &c.), and at such localities numerous level promenades and sloping paths enable patients to take graduated amounts of walking exercise in different directions. At some of these health resorts maps of the various paths have been printed by which the doctor can prescribe a series of walks for his patient and can thus regulate exactly the amount of every day's exercise and the time to be given up to it. In many cases where the exact regulation of the duration and intensity is not important, other forms of open-air exercise, such as cycling, riding, golf, and lawn tennis, can be substituted. Swimming is a form of exercise sometimes suitable in convalescents and others, especially in young persons, who often thoroughly enjoy it. Many spas and summer health resorts are provided with good swimming baths (fresh water or brine) or offer facilities for bathing in rivers, lakes or sea.

¹ See 'Ueber Terrain-Curorte zur Behandlung von Kreislauf-Störungen,' Leipzig, 1886.

In regard to the various forms of massage, passive exercises, Swedish gymnastics, and the so-called 'resistance gymnastics' (including the exercises devised by the brothers Schott, of Nauheim, for cardiac affections), skilled treatment may be obtained at many health resorts. At some resorts frequented by patients with nervous affections, such as Oeynhausien, in Westphalia, systematic exercises, after the method introduced in 1890 by Frenkel, of Heiden, in Switzerland, are made use of for the incoordination of movement in *tabes dorsalis* (see Chapter XXXIX).

Diet at Health Resorts.—For the many patients who visit health resorts on account of some disease of the digestive and metabolic organs a certain attention to diet is naturally of the utmost importance. For this reason *table d'hôte* dinners are somewhat inconvenient, and the *à la carte* system of many Austrian and German spas is mostly preferable. In some affections, special diet tables may be advocated. Long-continued errors in eating and drinking induce many of the conditions for which persons seek relief at mineral water health resorts, and it is only natural, therefore, that at this class of health resorts, rather than at simple climatic health resorts, most attention has been paid to diet. A special 'cure diet' was formerly observed by all patients at some spas, and traces of this custom may still be noted at Karlsbad and many mineral water health resorts. Individualisation in diet, as in other matters of treatment, is now held to be preferable, and even during courses of mineral waters it is rather the patient's constitution and disease which should be considered than the precise kind of mineral water which he is taking. (Cf. Chapter XVI.)

As a general rule, therefore, it may be said that there is no special diet for any health resort, but that the choice of food and arrangement of meals should depend on the nature of the patient's complaint. The same of course applies to drinks. Great care should be taken in regard to the use of the local country wines by those whose stomachs are not accustomed to them. The diet as well as the general regimen should often be left to the local doctor who is supervising the details of the climatic, balneotherapeutic, hydrotherapeutic, or other methods of treatment that may be adopted. In many gastric and intestinal complaints, as already stated, avoidance of *table d'hôte* and large meals is essential, and the local doctor can help the patient in regard to any difficulties. When there is uncertainty as to the purity of the water supply, information from him should be obtained as to what table waters &c. it is best to take. His instructions and supervision are still more important when a great portion of the treatment is dietetic,

as in grape cures and milk and whey cures, to which we shall refer later on.

Besides the nature of the patient's illness and his digestive peculiarities and previous habits, there are the quite ordinary circumstances which influence appetite and digestive powers; they are of course at work at health resorts as everywhere else. Such are the temperature of the air and the general bracing or sedative influences of the climate, the amount of exercise taken by the patient, and the time spent in the open air. Into these points we cannot enter here, but a word of caution cannot be omitted. The excitement of travelling and the change of surroundings at the commencement of a holiday or of a visit to a health resort often so stimulate the appetite that persons eat far more than they really require, and consequently suffer from biliousness and digestive disturbances which are further increased by the consumption of articles of diet to which they are not accustomed. Some persons at first suffer from diarrhoea, which is partly of nervous origin (especially in young and excitable subjects), whilst, on the other hand, in many cases travelling produces or increases a tendency to constipation. The constipation, which in its turn not rarely leads to attacks of diarrhoea, may be partly consequent on increased loss of fluid by the skin owing to muscular exercise, or on greater atmospheric dryness than the patient is accustomed to at home; sometimes it may be partly accounted for by a diminution in fresh vegetables, or (if for any reason raw fruit has to be avoided) by a difficulty in getting stewed fruit, or else, where the ground is chalky, by the constipating action of hard drinking-water. At the commencement of travelling or of a visit to a health resort, it is advisable to limit the amount of food and to be careful as to the kind of food taken, and also, in many cases, to regulate the bowels by drugs or aperient waters. This is especially important in persons of gouty tendency who have been leading sedentary lives. The mental excitement and increase of muscular exercise seem in such cases often to induce an extraordinary discharge of waste products from the system, shown by the urine becoming loaded with urates, by muscular and renal pains, and by biliousness, the excretory functions of the liver, like those of the kidneys, being probably overworked. Alkaline medicines and saline aperients can be employed in such cases.

Disorders of the same class are still more marked in visiting seaside localities, where the climate seems often to have the effect of stimulating the appetite without simultaneously increasing the digestive and metabolic functions to a corresponding extent.¹ In

¹ See 'On the Biliousness sometimes induced by Sea-Air,' by F. Parkes Weber, *Treatment*, London, January 11, 1900.

gouty patients and in patients with a tendency to constipation, biliousness, or hæmorrhoids, preliminary mercurial aperients can sometimes be recommended to ward off the disagreeable symptoms which in their cases frequently accompany visits to the seaside and sea voyages.

Persons seeking a warmer and sunnier winter climate at the interesting resorts of the South of Europe and Egypt are often tempted to over-fatigue themselves by sight-seeing, &c. And a few remarks here in regard to the **maintenance of health during travelling** will not be considered out of place. The chief causes of temporary indisposition to travellers, and at the same time very important predisposing causes of infectious diseases, are the following: (1) Dietary indiscretions, including too much food (often encouraged by the many dishes of table d'hôte meals), hurried and irregular meals, and foods or drinks to which the traveller is not accustomed; (2) nervous exhaustion (to which some persons, so-called 'bad travellers,' are notoriously peculiarly liable) from sight-seeing, &c., and from the mental unrest and repeated worry so often associated with rapid railway travelling, also, but less often, over-fatigue from long walks and other not specially psychical causes; (3) getting chilled. Even in hot climates flannel next the skin is often preferable when travelling. Constipation and diarrhœa should always be attended to, and errors in diet rectified. The local doctor should be early consulted in every case of doubt. A few days' rest (especially rest in bed) gets rid of many disagreeable and sometimes alarming symptoms of great variety, but all brought on partly, if not entirely, by mental fatigue. Needless to say when there is fear of typhoid fever, &c., unboiled water and milk, ices (ice-creams and water-ices), ice and iced drinks, uncooked oysters, and uncooked vegetables and fruits, should be entirely avoided. We cannot, however, here enter on the great and important subject of the avoidance of malaria and infectious diseases in tropical climates, for certainly invalids, and those in search of rest, recreation, and health, who wish to gain power to carry on their daily work, and strength to attain the objects of their life, should not be sent to insanitary places, however interesting and however attractive from other points of view.

Milk Cures, Grape Cures, &c.

Some health resorts have a great reputation for their good milk, koumiss or kephir, and others for their good grapes, wild strawberries, &c. This matter is important for cases in which a special dietetic use of milk derivatives, or of grapes or other

fruits, is to be made; it is still more important when a regular 'milk cure,' or a regular 'grape cure' &c. is to be tried.

Milk and Whey Cures, &c.—Milk is a complete food, which, in many cases, can be digested and assimilated when most other articles of diet disagree or are imperfectly assimilated. Cow's milk, the milk most employed, contains about 4.75 per cent. sugar of milk, 3.5 per cent. butter, 4 per cent. casein and albumen, 0.75 per cent. salts (especially phosphate of lime), and about 87 per cent. water. The milk of goats,¹ sheep, asses and mares is likewise sometimes employed, the first two chiefly in the form of whey. For many persons milk is a most important permanent article of diet, especially for those with weak digestions, the uric acid diathesis, nephritis, cystitis, anæmia, pulmonary phthisis, and various cachectic conditions. Special courses of treatment, during which milk, koumiss &c. constitute the chief or only article of diet, are often useful (sometimes also the alternate employment of a milk diet and of an ordinary diet) in chronic catarrhal conditions of the alimentary canal, nervous forms of dyspepsia in erethic individuals,² irritable hysterical conditions, neuralgias, chronic dysentery, psilosis,³ gouty conditions, the uric acid diathesis, and affections of the liver, kidneys, and bladder.

The milk diet, besides maintaining the nutrition, sometimes better than any other diet, gives comparative rest to the digestive organs, and acts as a diuretic, clearing out accumulated waste products, and, to some extent, purifying the blood and tissues of the body.

Owing to the calcium salts it contains, cow's milk must be regarded not only as a food, but also, as A. E. Wright and W. E. Paramore point out,⁴ as a medicinal agent. The calcium salts increase the blood-coagulability, and thus a milk diet may, as these writers explain, exert either a beneficial or a prejudicial effect. 'While' (they say) 'advantage may accrue from the prescription of milk in connection with hæmorrhage, aneurysm, physiological albuminuria,⁵ and the œdema of Bright's disease,' a milk diet may in some other cases do harm—for instance, according to Wright, in some enteric fever convalescents, by increasing a tendency

¹ The unpleasant flavour often noticed in goat's milk, and whey made from goat's milk, is peculiar to certain kinds of goats, or is due solely to the fresh aromatic herbs which the animals consume on pastures (and from which even cow's milk may derive a peculiar aroma). It is not noticeable at special establishments where the goats are stalled and kept to regular dry fodder.

² F. A. Hoffmann (Von Leyden's *Handbuch der Ernährungs-therapie*, 1898, vol. i. p. 581) remarks that a pure milk diet is the best remedy against the modern 'Polypragmosyne.'

³ See *Psilosis or Sprue*, by Dr. George Thin. Second edition, London, 1897, p. 131.

⁴ 'On certain points in connexion with the Exaltation and Reduction of Blood Coagulability by Therapeutic Measures,' *Lancet*, October 14, 1905.

⁵ See also A. E. Wright and G. W. Ross, 'On the Discrimination of Physiological Albuminuria from that caused by Renal Disease,' *Lancet*, October 21, 1905; see also the effects of a pure milk diet in checking the 'Albuminuria of Adolescents,' as described by Clement Dukes in the *British Medical Journal*, October 7, 1905, p. 848.

to thrombosis. According to the observations of G. W. Ross¹ a milk diet ought also to be useful in certain cases of headache associated with diminished coagulability of the blood.

It is probable that the routine employment of large quantities of milk, like mineral water, in renal affections, is occasionally injurious, especially, as Carl von Noorden points out, when there is a tendency to dilatation of the heart. In pulmonary tuberculosis, likewise, too large an amount of milk is sometimes recommended. Thus, Mitchell Bruce ('Principles of Treatment,' 1899) observes that when the appetite of a phthisical patient falls away, a purgative and several days' spare diet may be preferable to the abundant liquid nourishment usually insisted on.

There are certain persons who have a great repugnance to milk, and others who cannot take it on account of digestive disturbances (discomfort, vomiting, or diarrhoea) it sometimes causes, or because, owing to imperfect assimilation, its nutrient power is insufficient.

Often the milk is preferred raw and cold, or tepid from the cow, but unsterilised milk should be taken without boiling it only when it can be obtained perfectly fresh and pure from animals whose freedom from disease is undoubted. There are establishments, it may be mentioned, where, as at Obersalzbrunn, although special care is taken that the animals are healthy, the milk provided by the establishment is both purified by a centrifugal process and by sterilisation.

When boiled for too long a time the milk becomes indigestible for some persons and the taste is rendered unpleasant; but lightly boiled and taken warm, it is often more easily digested than when taken raw and cold. In the latter state it sometimes causes a disagreeable feeling of fulness and oppression in the epigastrium, and in those inclined to diarrhoea may induce an attack, though the same patients can often take it freely when lightly boiled (warm or cool), sometimes also preferring its taste thus—i.e. after being 'scalded,' as it is termed.

Sometimes on account of disordered state of the stomach or extreme disinclination the milk has to be taken in only very small quantities at a time, and this is not unfrequently the case on commencing a course of milk diet. Sometimes it is rendered more digestible or more palatable to the patient by the addition of artificial or natural gaseous waters (especially those containing bicarbonate of sodium or common salt, or, like Seltzer water, both together), barley water, lime water, bicarbonate of sodium or common salt; sometimes a little tea, coffee, 'acorn coffee,' or cognac may be mixed with it. Others again can take it better with dry toast or rusks (or with plain honey-cakes—German, 'Lebkuchen'—especially when there is a tendency to constipation), or in the form of 'bread and milk,' or boiled rice and milk. Such devices are not merely for increasing the palatableness. When the milk is sipped slowly and little taken at a time it is better mixed with saliva, and the tendency to form large and hard curds is lessened. The mere mechanical mixture of the milk in the stomach with minute fragments of bread or rusks, or with the starch mucilage from barley water, likewise hinders the forma-

¹ *Lancet*, January 20, 1906, p. 143.

tion of large hard curds; so also do the addition of sodium bicarbonate or other antacids, and dilution with plain water, lime water or alkaline mineral waters. The addition of a little sodium citrate, according to A. E. Wright's suggestion, prevents (one grain to the ounce) or diminishes the formation of hard curd.¹ In some cases, when there is a tendency to irritating fermentative changes in the alimentary canal with resulting digestive disturbance, A. Schmidt ('Muenchener med. Wochenschrift,' 1902, p. 274) mixes a little salicylic acid with the (boiled) milk, about 4-7 grains with $2\frac{1}{2}$ - $3\frac{1}{2}$ pints of milk.

As a food for some patients *cream* or the German '*sour milk*' (soured milk) may be employed instead of, or as well as, simple milk.

Skimmed milk, that is milk with much of its fat removed, is better borne than ordinary milk in some cases, and its greater diuretic action is useful in renal affections.

Butter milk contains much less fat and less casein than ordinary milk, and has a slightly acidulous taste owing to the presence of lactic acid and sometimes of a little CO_2 ; its aperient action may be useful in cases where there is a tendency to constipation.

Whey—that is, milk deprived of its casein and most of its fat—consists of the water, milk sugar, and salts of the milk with about 1 per cent. albumen. The relative percentage of the constituents can, however, be made to vary greatly by the mode of preparation. On account of the salts it contains, its action has been described as analogous to that of a mineral water, and it has a greater diuretic effect than ordinary milk, and sometimes a slightly laxative action. Dr. S. Gee² recommends a large teacupful of fresh whey taken after each meal against uric acid gravel. Whey (taken warm) has had an especial reputation in chronic bronchitis and pulmonary affections, where it often facilitates expectoration, increases the appetite, and helps to improve the general nutrition. It contains, however, very little nutrient material, and is used much less now than formerly. Whey is sometimes prescribed mixed with a mineral water, or with a preparation of iron (German, '*Eisenmolke*').

Koumiss is a drink made by a process of alcoholic fermentation from mare's milk—a kind of 'milk wine,' in fact; but in England the true koumiss of the Russian Steppes is imitated by a like fermentation of cow's milk. The *kephir* of the Caucasus is a drink formed from cow's milk through alcoholic fermentation set up by a special living ferment, the 'kephir grains.' The acidulous taste and the stimulating action of the CO_2 on the gastric mucous membrane sometimes render these drinks agreeable when ordinary milk is objected to. They are used in many cases of anorexia, anæmia, chronic pulmonary diseases, general debility, and various cachectic conditions. Badly prepared koumiss and kephir, owing to the presence of butyric and other acids, may do patients more harm than good,³ but it must be remembered that, according to Metchnikoff,⁴ sour milk, butter milk, and kephir, owing to the lactic acid they

¹ See A. E. Wright, *Lancet*, July 22, 1898, p. 194; and F. J. Poynton, *Lancet*, Aug. 13, 1904, p. 433.

² *St. Barth. Hosp. Journal*, January 1901, p. 50.

³ See the paper by Dr. W. Podwyssozki, of Odessa, on kephir, in *Zeitschrift für diätetische und physikalische Therapie*, Leipzig, 1902, vol. v. p. 595.

⁴ Vide E. Metchnikoff, *The Nature of Man*, English edition, London, 1904.

contain, tend to check the activity of intestinal bacteria (especially those of the large intestine), and thus prevent the chronic absorption of bacterial toxins from the large intestine, which is supposed to favour degenerative changes in the various tissues of the body and premature senility. For habitual use the German soured milk or butter milk is perhaps to be preferred to kephir, on account of the presence of alcohol in the latter.

The health resorts in Europe at which good milk, whey, koumiss &c. is provided, for special courses of treatment or otherwise, are far too numerous to be mentioned here. Amongst the oldest are Gais, Appenzell, and Heiden, in Canton Appenzell, in Switzerland. In other parts of Switzerland, in the Black Forest, and in various parts of Germany, there are numerous climatic health resorts suitable for milk cures. Some German mineral water health resorts, such as Obersalzbrunn, Reichenhall, and Reinerz, are famous for their whey. In France, likewise, there are localities, such as Gérardmer, Allevard, and Cauterets, where good milk &c. can be obtained, and is occasionally recommended as part of the treatment.

Grape Cures, &c.—A moderate quantity of grape acts, in suitable cases, as a bland and easily digestible carbo-hydrate food, but the nutrient value, like that of other fruits and fruit juices, is a very limited one. According to Koenig, the amount of grape-sugar contained in different kinds of grapes varies from 9·2 per cent. to 18·7 per cent. The quantity of grapes to be prescribed depends on individual peculiarities and on the effect which it is desired to produce. Large amounts have a purgative effect and lead to loss of weight. Relatively small amounts should be used to commence with, and the effect should be carefully watched in every case. Lebert,¹ who practised near Montreux, began usually with half a pound of grapes in the morning, fasting, and another half-pound at 5 P.M., but for some patients who did not bear the grapes well when fasting he ordered the first portion an hour or two after a very light early breakfast. Little by little he increased the dose to a pound on the average. In cases of chest disease, however, he often did not go beyond the half-pound. During the cure, other food should be taken in moderation. The diet should not be too exclusively composed of animal food, and alcoholic drinks, coffee, and tea should not be taken strong or in large quantities. A grape cure is useful in some cases of chronic constipation, abdominal plethora, and chronic bronchitis, but may be harmful in weak persons, especially in those with a tendency to looseness of the bowels. Therefore, medical advice should be obtained before commencing a 'cure.' B. Laquer,² of Wiesbaden, points out that

Metchnikoff concluded his second Harben Lecture (*Lancet*, 1906, vol. i. p. 1555) with the following summary: 'As putrefaction in the alimentary canal represented one of the causes of the general wear and tear of the human body it was only natural to suggest the method for combating it. That method might now be summed up in a few words—it consisted in the consumption of food-stuffs not contaminated with microbes or entozoa, and in the introduction into the alimentary canal of an artificially cultivated bacterial flora, foremost among which were the lactic acid microbes.'

¹ Burney Yeo's *Climate and Health Resorts*, London edition of 1893, p. 313.

² *Zeitschrift für diätetische und physikalische Therapie*, 1899, vol. iii. p. 45.

grapes relieve thirst, are slightly diuretic, and tend to lower the acidity of the urine. As part of the treatment for obesity and constipation he has employed grapes with satisfactory results, but the diet should be suitable, and additional treatment, such as hydrotherapy, &c., may be advisable. The grapes should always be washed before being eaten, and should not be too cold. The skins of grapes contain tannic acid, and in cases of constipation it may be well to give the juice only, but in general Laquer recommends that the skins be chewed and then ejected. In regard to other 'fruit cures,' the astringent action of bilberries (due to the tannic acid they contain) is sometimes made use of. The effect of taking strawberries has been highly appreciated by Linnæus and others,¹ but in some persons this fruit gives rise to cutaneous irritation, eruptions and other troubles.²

Grape cures can, of course, be most readily carried out at the places themselves where the grapes used in the treatment grow, provided that the quality of the grapes is good. The treatment may, however, be obtained at many other localities which are provided with grapes by railway. The quality of the grapes is in some seasons better at one place, and in other seasons at other places. Amongst the many localities for a grape cure the following may be mentioned: Meran, Botzen and Gries; Arco; Abbazia; Montreux, Vevey, Territet, and neighbouring localities on the Lake of Geneva; Bex; Interlaken; Dürkheim, Neustadt, Edenkoben, Gleisweiler, and Annweiler, in the Bavarian Palatinate; Rüdesheim, Assmannshausen, and many other localities on or near the Rhine; Voeslau, in Austria, &c. The season for grape cures is generally September to November, but varies naturally in different places; Spanish grapes may be obtained in winter.

Hydrotherapy, Hot-air and Vapour Baths, and other kinds of 'Accessory Spa Treatment' have been discussed already in Part II (Chapters XII and XV).

Sea-bathing may be again referred to here, since the beneficial effect of residence at a seaside climatic resort in summer is sometimes nearly as much due to the bathing as to the mere climate of the place. Certain precautions should be observed. In delicate and timid persons and children the treatment should be commenced with baths of warmed sea water in the house or in a bathing establishment. The duration of the baths in the sea should be extremely short at first, and should, in fact, never be very long, except in the case of very robust individuals.

¹ Apparently remarkable instances of the dietetic value of strawberries in severe cases of sprue have been recorded by Dr. E. H. Young (*Lancet*, March 28, 1903, p. 873), and by Dr. M. F. Squire (*Lancet*, December 15, 1906, p. 1659).

² It is possible that in predisposed persons the disadvantages of strawberries and other fruits might be avoided by the simultaneous use of calcium salts. Cf. Chapter XL, on Affections of the Skin. According to G. W. Ross (*Lancet*, January 20, 1906, p. 147) strawberries ought to be avoided in certain forms of headache &c. associated with diminished coagulability of the blood.

Bathing in the open sea is generally to be avoided in chronic diseases of the ear and tendency to aural catarrh. When sea-bathing is followed by too great a feeling of fatigue, or by headache, by sleeplessness, by a cutaneous eruption, or by loss of appetite (with or without obvious dyspepsia) and loss of weight, the bathing should be of much shorter duration or should be abstained from temporarily or altogether. Persons unless they are thoroughly hardened to sea-bathing should never bathe in the open sea before breakfast, and never without first of all taking a biscuit, cup of tea or milk, or something of the kind. Those liable to itching or urticaria after bathing, especially typical subjects of factitious urticaria, must not use a flesh brush or rough towel, and must dry the skin thoroughly with a large soft bath towel, which in some cases should be previously warmed; this applies not only to sea-bathing, but more or less to all kinds of bathing. (See also the section on Sea Water and Sea Water Baths at the end of Chapter XVIII.)

Clothing.—Patients often want to know what kind of clothing they are to take with them to a health resort. This must depend, of course, on the kind of weather they are likely to meet with. A spell of bad weather may be a troublesome, unexpected factor in climatic treatment, for at no place, not even in Egypt and the most famous climatic resorts, can constancy of the weather be absolutely relied on, and visitors should always be prepared in regard to clothing. For most persons, even healthy ones, flannel next the skin is to be recommended for travelling, and especially for places where great and rapid variations in temperature, moisture, and wind occur. Thin flannel under-clothing can be worn even in the tropics. Information as to the average temperatures, winds, and sudden variations of temperature likely to be met with at a particular season of the year can be sought for under the head of the particular health resort in question. With the special questions of outfit, food &c. for explorers and persons having to visit unhealthy climates (i.e. the reverse of health resorts) we are of course not concerned here.

Medical Supervision, &c.—For all serious invalids, and for many of the less serious cases, supervision by the doctor at the health resort is required; the medical man, in fact, forms an essential part of the health resort, and upon his skill and tact depends much of the usefulness of the health resort in which he practises. On reaching the health resort the patient should immediately consult him, and the advantages which one is likely to derive from this plan have already been explained in part.

Neglect of this rule often leads to troublesome symptoms of more or less importance, which might easily have been avoided, and for which the climate and arrangements of the health resort in question are unjustly blamed. Frequently the first exhilarating effects due to change of climate, scenery, and surroundings induce a patient to eat too much and over-exert himself in various ways. In sight-seeing many persons will unnecessarily expose themselves to chills; anæmic persons will frequently take long walks and otherwise tire themselves out in order to keep company with their more healthy friends; all such evils can and must be prevented by the influence of the local medical man. He has often to regulate the diet and the amount of exercise, give the patient directions as to clothing and how to make the best use of the fresh air. He can tell the patient what baths and hydrotherapeutic measures are required, and whether massage, Swedish gymnastics, and electrical treatment should be employed. In regard to mineral waters he has to prescribe the proper amount, the time of day at which the water is to be taken, and give directions whether it is to be taken at the natural temperature of the spring or artificially cooled or heated, and whether it is to be taken alone or mixed with salts, milk, whey, &c. He can insist on a sufficient interval of time (see Chapter XVI) being observed between drinking the waters and commencing a meal. In no case, except the slightest, should a health resort be selected where efficient medical supervision cannot be obtained. (See also Chapter XVI.)

CHAPTER XXX

SANATORIUM TREATMENT

Sanatorium Treatment.—The personal supervision by the medical man can be generally better carried out in special institutions than when the patient is residing at hotels or in private houses. This is one of the causes which has led to the establishment of a great variety of private sanatoria where there is resident medical superintendence, or where at least effectual medical supervision can be carried out. A number of dietetic establishments have been founded during the last twenty-five years in Germany and elsewhere. Some of the best known of these are at Heidelberg, Würzburg, Frankfurt-am-Main, Kissingen, Homburg, Neuenahr, Wiesbaden, Baden-Baden, Rigi-Scheidegg, and several health resorts mentioned in Parts I and II. At such establishments dietetic and other treatment for digestive disorders, diabetes, obesity &c. can be thoroughly carried out, and the effects of trials in diet, drugs &c. can be more accurately observed. There are likewise a great number of private sanatoria for skin affections, nervous affections, gynæcological affections &c. where special facilities for treatment and medical supervision can be obtained. In some cases the restraint imposed upon the patient at such establishments is the chief agent of treatment—for instance, at homes for dipsomaniacs and morphinomaniacs. Well-conducted sanatoria, moreover, favour the investigation and study of special diseases, and will probably be more and more made use of in the future. Special hospitals for particular groups of diseases, such as are now found in all large cities, are really special sanatoria for the poorer class of patients.

It is in the treatment of pulmonary tuberculosis that the utility of special sanatoria has in recent years been everywhere acknowledged. The main characteristic of these institutions is the value attached to open air, or rather pure air, to a nourishing diet, and to the personal medical supervision of each patient. The doctor comforts the patient, gives him courage and hope, prevents him over-fatiguing himself, remaining too long without

food, or otherwise diminishing his chances of recovery; he has to regulate the amount of exercise, the tonic hydrotherapeutic measures, &c. From residence in institutions of this kind the patient acquires hygienic knowledge and habits, and learns how to avoid infecting others; in fact the treatment is 'educational,' and will almost certainly be useful to the patient in regard to his subsequent life, and not only to the patient himself, but also to other persons with whom he lives or with whom he comes in contact. It is unlikely in most cases that the disease can be permanently cured by a few months' residence in a sanatorium, but the patient learns how to regulate his life, and by afterwards keeping to hygienic habits will have the best chance of 'battling successfully with the disease and ultimately getting rid of it. The same methods which would probably have prevented the disease if they had been adopted early enough, are made use of in the sanatorium or 'open-air' treatment to increase the patient's general strength and resisting powers, so as to enable him to cope with the disease after it has attacked him.

In England, George Bodington,¹ of Sutton-Coldfield, enunciated the hygienic principles of treatment in regard to diet, fresh air &c. as early as 1840. Dr. John Hughes Bennett² believed in the value of open-air exercise³ and nourishing food, and so did Sir

¹ In an essay on the 'Treatment and Cure of Pulmonary Consumption' (published in London in 1840), on page 44 Bodington writes: 'The generality of the medical profession have not the opportunity of thus treating their consumptive patients; if they are to succeed they should have country houses in proper situations, well ventilated, and provided with all "appliances and means to boot," where their patients should be under their own eyes, and strictly watched and regulated in all respects as regards exercise, air, diet, medicine, &c.; or there should be a certain class of practitioners who should exclusively pursue this practice as a distinct branch, to whom those in the large towns should confide their consumptive patients. With respect to the consumptive poor patients, those who cannot afford to pay for a proper treatment of this sort, hospitals should be established in the vicinity of large towns, in fit situations, and properly appointed in all respects for their reception and treatment. In these there should be provision made for affording them carriage or horse exercise; and gardening and farming occupations for the convalescent. The common hospital in a large town is the most unfit place imaginable for consumptive patients.' For further evidence of Dr. Bodington's methods of treatment see 'The Origin of the Modern Treatment of Pulmonary Consumption,' by A. T. Tucker Wise (*British Medical Journal*, Feb. 22, 1902, p. 447) and *The Sanatorium Treatment of Consumption*, by T. N. Kelynaek (London, 1904). See also Dr. A. E. Bodington's preface to a modern reprint (Lichfield, 1906) of the original essay of Dr. George Bodington.

² See *The Pathology and Treatment of Pulmonary Consumption*, first edition, Edinburgh, 1853, pp. 78-80.

³ Whatever part open-air exercise takes in the treatment of pulmonary tuberculosis and whatever its dangers (fatigue from walking, climbing and sports, and traumatic effects on the lungs from sudden and violent movements of the body and upper extremities) may be in the absence of medical supervision, there can be no doubt of its great preventive value in regard to the disease. Bond Stow (*American Journ. Med. Sci.*, October 1906, p. 606) regards the hyperæmia of the lungs (congestion of the lesser circulation) associated with breathlessness from running as of great importance from this point of view.

Benjamin Ward Richardson.¹ Dr. Henry McCormac,² in Ireland, specially insisted on the avoidance of confined air. But the practical introduction of the systematic open-air and general hygienic treatment of pulmonary tuberculosis is due to Dr. Hermann Brehmer, who founded his private sanatorium at Goerbersdorf, in Prussian Silesia, in 1859. The sanatorium at Falkenstein, in the Taunus, was founded at the instigation of Frankfurt doctors in 1874, and was opened in 1876. Dettweiler, a former assistant of Brehmer, in his management of the Falkenstein establishment introduced certain modifications in Brehmer's treatment, especially the various arrangements to enable patients to rest lying down in the open air in nearly all weathers during the greater part of each day. The excellent results obtained at these two establishments have led to the foundation of a number of different private sanatoria not only in Germany, but in every country of Europe, and in various parts of America. We need only mention the sanatorium of Hohenhonnef on the Rhine, those at Goerbersdorf besides Brehmer's original one, those at high altitudes in Switzerland (Davos, Arosa, Leysin), those in the Black Forest, in Saxony and Thuringia. Every country in Europe has provided itself or is providing itself with sanatoria for pulmonary tuberculosis. In England private sanatoria exist at Bournemouth; near the Norfolk Coast; in the Mendip Hills; in the New Forest; in the Cotswold Hills; in hilly districts near London; and in other places. Many such sanatoria in England and various parts of Europe have been referred to in Part I of this book, and quite a number exist in North America.

The lines of treatment adopted at all these sanatoria are similar in their broad principles, but at some of them especial attention is paid to certain details. At Nordrach, in the Black Forest, under the direction of Dr. Walther, especial importance has been attached to the amount of food, whilst the large open galleries or verandahs ('Liegehallen'), in which patients at Falkenstein and Hohenhonnef spend much of the day reclining on their couches, are not in favour. Exact directions are, however, given to each

¹ *The Hygienic Treatment of Pulmonary Consumption*, London, 1857. In this book Richardson refers to the American physicians Rush, Parrish, and Jackson, who proclaimed the importance of open-air exercise as a therapeutic agent. The famous American physician Benjamin Rush, who, in his turn, referred to the recommendation of riding on horse-back by Thomas Sydenham in England, wrote (*Thoughts upon the Cause and Cure of the Pulmonary Consumption*, 1789) as follows: 'Such occupations as require constant labour or exercise in the open-air, in all kinds of weather, should be chosen for a young man who, either from hereditary predisposition or an accidental affection of the lungs, is in danger of falling into a consumption.'

² See *On the Nature, Treatment, and Prevention of Pulmonary Consumption*, London, 1855; second edition, 1865; *Consumption and the Breath Re-breathed*, London, 1872.

patient as to the amount of walking and resting in the open air ; in feverish patients and others specially needing rest, Dr. Walther prefers to prescribe absolute rest in the thoroughly well-ventilated and well-situated private rooms. We have not sufficient space in this book to discuss the details of the modern sanatorium treatment of pulmonary tuberculosis, but for a consideration of its methods and its results we refer to the following works : F. R. Walters, 'Sanatoria for Consumptives,' third edition, 1905 ; K. Turban, 'Beiträge zur Kenntniss der Lungen-Tuberculose,' 1899, and his other writings ; A. Ransome, 'The Principles of Open-Air Treatment of Phthisis,' London, 1903 ; S. A. Knopf, 'Pulmonary Tuberculosis: its Modern Prophylaxis and the Treatment in Special Institutions and at Home,' Philadelphia, 1899 ; A. C. Latham, 'The Early Diagnosis and Modern Treatment of Pulmonary Consumption,' London, 1903 ; A. Hillier, 'The Prevention of Consumption,' London, 1903 ; C. E. Reinhardt and D. Thomson, 'Handbook of the Open-air Treatment,' London, 1902 ; and T. N. Kelynack, 'The Sanatorium Treatment of Consumption,' London, 1904. The *Lancet* for January 3, 1903, contains the three 'King's Sanatorium' Prize Essays, namely, those by A. C. Latham, F. J. Wethered, and E. C. Morland ; whilst the number of the *Lancet* for January 6, 1906, contains a collection of critical articles by various authorities on the 'Sanatorium Treatment in its Therapeutical and Economical Aspects.' See also S. E. Solly's critical paper on 'Sanatorium Treatment and its Relation to Climate,' in the *Philadelphia Medical Journal*, December 1, 1900 ; O. de la Camp's critical paper entitled 'Lungenheilstättenerfolg und Familienfürsorge,' *Zeitschrift für Tuberkulose*, Leipzig, 1906, vol. viii. p. 120 ; H. Weicker, 'Tuberkulose-Heilstätten-Dauererfolge,' Leipzig, 1903 ; E. Meissen's 'Bericht über 208 seit 3-11 Jahren geheilt gebliebene Fälle von Lungentuberkulose (aus der Heilanstalt Hohenhonnef),' *Zeitschrift für Tuberkulose*, 1903, vol. iv. p. 115 ; F. Reiche, 'Die Dauererfolge die Heilstättenbehandlung Lungenschwindsüchtiger,' *Münchener med. Wochenschrift*, August 19, 1902, page 1369 ; Lawrason Brown's 'Analysis of Fifteen Hundred Cases of Tuberculosis discharged from the Adirondack Cottage Sanitarium from Two to Eighteen Years Ago,' *Journal of the American Medical Association*, November 21, 1903 ; F. Köhler, 'Die Bewertung der modernen Lungenheilstättenbehandlung im Lichte der Statistik,' *Münchener med. Wochenschrift*, 1903, No. 19, page 809 ; E. Rumpf, 'Zur Prognose der Lungentuberkulose' (including some interesting figures showing results obtained at the Friedrichsheim sanatorium of the Baden Insurance Company), *Münchener med. Woch.* 1906, No. 29, p. 1407 ;

J. Nagel, 'Tausend Heilstättenfälle' (statistics from the Cottbus Sanatorium), *Beiträge zur Klinik der Tuberkulose*, Würzburg, 1906, vol. v. pp. 451-505 (see the portion on 'Dauererfolge,' p. 501); 'Ergebnisse des von der Landes-Versicherungsanstalt der Hansestädte eingeleiteten Heilverfahrens bei lungenkranken Versicherten bis Ende 1904,' Hamburg, 1905; and H. Gebhard, 'Die Dauer des Erfolges des von der Landesversicherungsanstalt der Hansestädte bei Lungenschwindsüchtigen eingeleiteten Heilverfahrens,' *Zeitschrift für Tuberkulose*, Leipzig, 1906, vol. viii. p. 134. N. D. Bardswell's *The Consumptive Working Man: What can Sanatoria do for him* (London, 1905) deals with a very limited number of cases, but these are carefully considered from the economic and social points of view. In regard to the results obtained at sanatoria in mountainous situations, see also W. Ost's collective statistics of eight sanatoria in the Alps of Switzerland, *Zeitschrift für Tuberkulose*, 1906, vol. viii. p. 207. To these we shall refer again in our remarks on the climatic treatment of Tuberculosis in Part III, Chapter XXXIII.

Tuberculosis can, however, only be efficiently combated when means have been provided for dealing with its poorer victims. In this respect England has led the way by the early establishment in London of special hospitals for the poorer class of patients, and by the erection of the 'Royal National Hospital' (1869) at Ventnor, in the Isle of Wight, and the 'Royal National Sanatorium for Consumption' (instituted in 1855) at Bournemouth. This example has been followed abroad; a temporary sanatorium for poor consumptives was established in 1892 at Falkenstein, close to the celebrated private sanatorium managed by Dr. Dettweiler. In 1895 a much larger sanatorium for poor patients was erected at the neighbouring Ruppertshain, and the small one at Falkenstein was discontinued. Now there are sanatoria for poor consumptives scattered about in different parts of Germany and Switzerland, England, France, Denmark, and other countries. In the south of England, for instance, there are the sanatoria near Midhurst (the King's Sanatorium), and near Camberley (the sanatorium branch of the Brompton Hospital for Chest Diseases, London), and the establishments at Ventnor and Bournemouth. In London itself, the Mount Vernon Hospital has an elevated position close to Hampstead Heath and is an excellent example of a town or suburban hospital for poor consumptives where the 'open-air treatment' is carried out. It has a fine branch sanatorium at Northwood. At Edinburgh the open-air treatment for poor patients has been carried out for years at the Victoria Hospital, Craigleith. More institutions, however, are needed, not only sanatoria for patients who are 'favourable cases' and have a good chance of recovering so far

as to be able to earn their living again, but also homes for the advanced and hopeless cases, where the poor patients may spend the remainder of their life in as comfortable circumstances as possible without the danger of infecting others.

The charitable sanatoria for scrofulous and weakly children are of almost equal importance. The Royal Sea-bathing Infirmary at Margate, founded in 1791, was the earliest of this class of charitable institutions. The largest, however, and probably the best known, is the French one inaugurated in 1869 by the 'Assistance Publique de Paris' at Berck-sur-Mer, on the English Channel. In Part I were mentioned a large number of these institutions scattered over the coast of Europe, as well as some similar ones at various inland localities, especially those provided with brine springs which can be employed for stimulating baths. In this connection the importance of convalescent homes, rural 'colonies' and holiday homes or 'colonies' for children—especially weakly ones—of the poorer classes, whether at healthful inland or seaside localities, must not be overlooked.

In regard to the education of children, general weakness and a tendency, hereditary or otherwise, to tuberculosis should be always taken into consideration. Requirements as to food, fresh air, and physical exercise must be noted. On the Continent already much is being done in this direction; the establishment of open-air schools in the woods near Berlin, during the summer months, is only one example of what is being done for weakly children of the poorer classes. For weakly children of wealthy or well-to-do parents there are various climatic resorts on the Continent where educational requirements can be provided for. In England there now exist private schools where children with a tendency to tuberculosis can be educated under medical supervision on modern open-air-sanatorium principles.

Lastly, it seems clear to us that in the fight against tuberculosis, intimately connected though consumption is with poverty, private charity in regard to hospitals and sanatoria, even as represented by the magnificent donations towards such institutions in England, is insufficient.¹ Compulsory universal insurance of the working classes (against disease, accident, death, infirmity and old age, as in Germany) under State control is needed. In fact, the State, whether from paternal Imperial motives or on account of the modified socialistic tendencies of modern times, ought to undertake the direction of the forces and assume all the responsibility connected with leadership.

¹ Cf. J. E. Squire, *Tuberculosis*, London, November 1906, p. 114.

CHAPTER XXXI

GENERAL CONSIDERATIONS IN REGARD TO THE SELECTION
OF HEALTH RESORTS

IN advising a patient about health resorts the physician has to take a number of circumstances into account. Not only the action of the climate, mineral waters, baths, &c., but the probable effects of the proposed journey, the removal from home surroundings, the altered diet and altered mode of life, have to be considered. Some knowledge of the local medical man is of great importance in the selection of a health resort, but to this we have already referred. Climate is unfortunately an unstable agent, the variations in which cannot be foreseen. Egypt has been supposed to have the most stable climate, one on the action of which the physician could rely almost as much as on a dose of some drug of known strength and quality, but H. Weber, from his personal experience, thinks that after all Egypt forms no exception to the rule.

In the medical treatment of chronic disorders the physician's aim must be, firstly, to remove the injurious influences which are causing the disease, and, secondly, as far as possible to restore the normal functions of the organs. The first of these objects may in practice often best be effected by removing the patient for a longer or shorter time from his usual work and surroundings. It is partly owing to rest and recreation¹ that treatment by climates and health resorts often succeeds when ordinary medicinal treatment, and sometimes every kind of treatment at home, has failed. The stay at a health resort necessitates removal from ordinary work and surroundings. In many morbid conditions change by itself does good, travelling by sea or land, or temporary change of residence from a large town to the country, or *vice versâ*. Hippocrates² said, 'In longis morbis solum vertere conducit.' Mental

¹ We have already alluded to the effects of rest and recreation in regard to treatment at health resorts. See Chapter XXIX.

² Ἦν μεταμίσθων σύμφορον ἐπὶ τοῖσι μακροῖσι νοσήμασιν (In longis morbis solum vertere conducit), Hippocrates, *Epidem.*, Lib. vi, Sect. 5, Aph. 19.

and social conditions doubtless often play a part in the effects apparently due to 'mere change.'

Sir H. Weber (Von Ziemssen's 'Handbook'), in regard to old persons, says: 'The fact must not be lost sight of that in them all functions, both of the mind and of the body, have a tendency to become torpid unless they are kept in constant exercise, so that it is necessary to keep the faculties in action by stimulating body and mind. For this reason voyages are indicated, and residence at places where the mind is stimulated by social intercourse, art treasures, and other resources, and where at the same time facilities for bodily exercise are offered.'

Even in tuberculosis, although the tubercle bacilli cannot be at once got rid of by change of surroundings, yet the injurious agents—insufficient food, impure air, &c.—which have lowered the vitality of the body and enabled the pathogenic parasites to gain a footing can be removed by the judicious selection of a climate or sanatorium.

In regard to the second object to be obtained by treatment, namely, the restoration of the proper functions of the organs, it is the constitution of the patient which the physician has specially to consider.

Constitution of the Patient.—Under this term we include the general strength and the reactive peculiarities of the individual. Strong constitutions may be due to inheritance or to the physical influences which have acted on a person during early life. Weak constitutions are often inherited, but are frequently also the result of improper feeding and insufficient opportunity (by open-air exercise, &c.) for proper physical development, that is to say, are caused by insanitary influences (including infectious diseases). Nervous irritability is the characteristic of some constitutions, and in selecting a health resort for these constitutions the avoidance of all sources of excitement and unnecessary irritation is to be the first aim.

On the other hand, in the 'torpid' class of persons the nervous system is less readily influenced, therapeutic agents produce a less obvious effect, and in general a more active kind of treatment, combined with stimulating mental influences, is required.

The reactive power of the constitution in regard to cold, fatigue &c. is of great practical importance, and it is the physician who most intimately knows the peculiarities of his patient in this respect who is most likely to be successful in his treatment. A powerful reaction belongs mostly to the strong constitution, but strong measures are often required to produce it, whereas in irritable weak constitutions the reaction is generally excited more rapidly and by less violent means. Thus in strong constitutions

the sharp action of a purgative is mostly followed by increased appetite and working power; in weak constitutions it often leads to more or less marked depression, which is more or less slowly recovered from. In strong constitutions even a great amount of fatigue is soon recovered from, and is followed by a pleasant feeling of increased vigour, whereas in weak constitutions great exertion may be followed by a long-continued loss of working power, both physical and mental. A man of vigorous constitution is often greatly benefited by a long period of abstinence or under-feeding, and in such persons this simple method of dietetic treatment may in itself be sufficient for many ailments. Temporary loss of weight and diminution of working power are in these persons rapidly followed by increase in weight and vigour when they return to the average amount of food. In weak constitutions under-feeding may have a very different effect, and to a certain extent even the strict observance of fast days in the Roman Catholic Church may exercise an injurious action, for such weak persons have apparently little nutrient material to draw from. They stand over-feeding often as badly as under-feeding, and when they attempt to live 'generously,' suffer immediately from indigestion, rheumatic pains, &c. In estimating the constitution of the patient, the general appearance, the vascularity of the skin, and the amount of muscle and subcutaneous fat may help the physician. He can likewise learn much by ascertaining how the pulse reacts to mental excitement and sudden physical exertion, whether the skin is usually dry or whether there is a tendency to excessive perspiration, whether the patient is peculiarly liable to coldness of the hands, feet, and nose, whether he feels stronger, happier, and capable of more work in summer or in winter, and whether the family history shows a tendency to longevity or the reverse. Some of these points will be again referred to later on in discussing the climatic treatment of tuberculosis.

In selecting climatic health resorts it is in all cases important to ascertain whether the patient stands cold well or badly. Many patients, like most healthy persons of strong constitution, are invigorated by cold weather; especially is this the case in large eaters and persons with a tendency to abdominal plethora and corpulence, to somnolence in hot weather, and to a torpid type of hypochondriasis. Some delicate persons, on the other hand, are liable to suffer from loss of appetite, constipation, coldness of the extremities, mental depression, anæmia, and amenorrhœa in cold weather. Some persons always have coryza or catarrhal affection of other mucous membranes in winter. Some persons (especially children and young persons with 'weak circulations') suffer in cold weather from chilblains on their hands and feet or from

swelling with redness or lividity of their hands, feet, nose, and cheeks—a form of ‘acrocyanosis.’ Other persons develop transverse atrophic furrows across their finger nails (as after typhoid fever, scarlatina or other acute infectious diseases and after various temporary conditions of impaired nutrition), or in rarer instances recurrent cutaneous troubles (‘winter eruptions’) when exposed to cold. Paroxysmal hæmoglobinuria has been avoided by migration to warmer climates. All these considerations can furnish hints in the selection of a climate.

Journey to the Health Resort.—The question sometimes arises whether the patient can stand the journey to the health resort or not. In such cases the knowledge of the patient’s previous habits and reactive powers may greatly help the physician in drawing a conclusion from the data furnished by his examination of the present condition. Anyhow, when there is weakness, every precaution ought to be taken to make the travelling as little fatiguing as possible. The journey should be carefully planned out beforehand, and the places for resting at should be selected. In trains specially adapted for invalids a long journey can often be accomplished, even by weak persons, without excessive fatigue. In other circumstances frequent breaks are necessary, and sometimes a stay of several days’ duration at one or more places on the route is advisable. Some patients bear night travelling badly, but during the heat of summer the night is often the most agreeable time for a journey. In very hot weather travelling may sometimes be limited to the early morning and the evening hours.

The **season** of the year naturally influences a physician largely in the choice of a health resort; not only does the climate differ greatly at different times of the year, but some health resorts are only opened during a limited season. The accommodation is often better at one season of the year than at another; moreover, mineral water treatment, medical baths &c. are not available during part of the year in many health resorts which have an especial mineral water season. Thus St. Moritz, in Switzerland, is open in winter only as a climatic resort, not for its mineral waters. Still more important is the fact that the resident medical men in whom confidence is placed may only be present during the chief season. Amongst well-known thermal resorts available during the winter months are Bath, in England; Aix-la-Chapelle, Baden-Baden, and Wiesbaden, in Germany; Dax and Amélie-les-Bains, in France; Acqui, in Northern Italy; Termini-Imerese, in Sicily; Helouan, in Egypt; and Hammam R’Irha, in Algeria; the last place is much frequented during spring and autumn (November). At some health resorts the middle of the summer

may be too hot, or the crowding or fashionable excitement may be too great at the height of the season, for certain patients.

The **expense** of treatment and various other social considerations often necessarily limit the physician in his choice of a health resort. Treatment at health resorts is generally expensive, but the expense varies greatly according to the fashionable nature of the place, the quality of the accommodation, the time of the year (whether at the height, commencement, or end of the season), and the quarter of the health resort selected for residence.

The **inclinations** of the patient must necessarily often affect the choice of treatment, and when different methods are applicable, even the physician's advice will have to be modified by the mental attitude of the patient. Some persons will refuse to leave their friends and relations to visit a health resort; others long for bright vegetation and a clear sky. Thus H. Weber and M. G. Foster say: 'More than once, especially in former years, patients would tell us they would rather die in the enjoyment of the sub-tropical beauty of Funchal than fight for life in the ice-bound Alps, or at the dusty Riviera, or in sunless England.'

Opportunities for 'Open-air' Treatment.—It is not only in pulmonary tuberculosis that 'open-air' treatment is of use. It can be employed with advantage in various local tuberculous affections, various neurotic disorders, and, combined with diet, in chronic disorders of metabolism where there is imperfect combustion. In most cases, therefore, it is important to select a health resort where there are plenty of good paths (shady ones are necessary in hot weather), both level paths for ordinary walking and gently sloping paths for climbing exercise. In many cases not only should there be opportunities for exercise in the open air, but there should be abundant facilities for resting in the open air. There should be proper verandahs, provided with invalid chairs (of the 'chaise longue' kind) for reclining; hammocks should be furnished for the woods, and there should be comfortable seats at various spots along the paths; the so-called 'sun-traps' are also desirable, and seats which can be turned round with high backs to afford shelter from the wind. Of course there must be chairs for invalids to be wheeled about in, and carriages for driving. In some cases one of the main advantages derived from selecting a warm locality for winter is that the patient, besides taking his exercise out of doors, can spend much time resting in the open air. Moreover, as one approaches the equator, the days become longer and the possible duration of sunshine is increased; from the invalid's point of view the difference between England and the Mediterranean coast in this respect is quite appreciable during the short winter days.

We need not here again discuss the probable action of **sunlight** upon the mind and general nutrition (see Chapter I), nor the influence of the invisible 'chemical' rays (those at the violet end of the spectrum) and their relative abundance in high altitudes and elsewhere (see Chapters I and II). At some health resorts, such as Veldes, the maximum effects of sunlight and pure air are obtained by 'sun baths' or 'air baths,' that is to say, by the patients during some part of the day in favourable weather exposing their bodies, practically unclothed, to the open air and sunlight.

Before we proceed to the selection of climates and health resorts in special diseases, we must say a few words on the **selection of rooms and dwellings** in health resorts. The selection of the house or the hotel is often a matter of some importance. We need hardly mention the difference between different hotels and lodging-houses in regard to sanitary arrangements,¹ general comfort, quality of the food and cooking, expense, and class of society. The situation and aspect of the dwelling and of the patient's room must be ascertained, and the shelter from wind, elevation, sunshine, look-out, and nature of immediate surroundings, often differ much in different parts of the same health resort. There may be a difference of 300 feet and more between different portions of the same health resort. At seaside places the houses bordering the seashore or harbour have a different climate in regard to winds &c. from that of houses built on slopes or cliffs one or two hundred feet above them (often at a considerable distance from the shore). In inland resorts some of the houses may be situated in a kind of hollow, whilst others situated on adjoining slopes or plateaux have a much more bracing climate. The houses built on rather steep slopes necessitate too much climbing exercise for patients with dilated hearts, &c. Hotels on the outskirts of a health resort have the advantage sometimes of standing in large grounds of their own, and sometimes of adjoining large forests and the open country, and of being comparatively removed from the dust and glare of chalky or sandy roads.

Even the kind of furniture and decoration of the halls, verandahs &c. is of some importance, because it may conduce to cheerfulness or otherwise; and cheerfulness has a most beneficial influence in chronic ailments. We need hardly discuss here the many important hygienic considerations bearing on the

¹ In the future, health and holiday resorts will be probably more and more considered in regard to their hygienic conditions. On this subject see 'Die gesundheitlichen Mindestforderungen an Badeorte,' by Dr. Hans Ruge, *Berliner klin. Wochenschrift*, April 17, 1905, p. 466. See also the admirable common-sense remarks by Dr. Leonard Williams in his paper on 'Some Practical Points in Climatology,' *Clinical Journal*, London, August and September, 1903.

flooring, walls, ceiling, furniture, and decoration of rooms, and on the methods of warming and ventilation employed. In rooms to be let out to sick persons and invalids, the general arrangements should be calculated to minimise trouble in cleaning, to secure adequate ventilation, to prevent as far as possible any accumulation of dust, and to render immediate and complete disinfection easy. In regard to modern sanatoria for tuberculous patients, the risk of infection has been duly recognised, and the general arrangements and regulations in force make transmission of the contagion extremely unlikely; so much so, in fact, that a person employed in a good modern sanatorium for consumptives is probably less likely to become consumptive there amidst tuberculous neighbours than when living elsewhere amongst apparently healthy persons. That the strictest modern hygienic precautions in regard to the fitting out of rooms do not in any way necessitate the sacrifice of ordinary comfort and 'cheerfulness,' and are not incompatible with highly artistic decorative effects, an inspection of recently erected establishments abundantly proves.

During the hottest months the highest story of the house and the western and south-western rooms, on which the sun shines during the evening hours, are to be avoided by those who cannot sleep in hot rooms. The upper stories are, needless to say, not suitable for aged and enfeebled persons, especially persons with dilatation of the heart, unless there is a good lift. In warm sunny climates, such as, for instance, in some Spanish towns, the ground-floor rooms are almost sunless, and though cool and pleasant to sit in during the hot summer months should be avoided by invalids during the winter season, when the sunnier and warmer upper stories will be found preferable. At some places, such as Venice, the possibility of the lower rooms being damp forms an additional reason for selecting upper ones.

CHAPTER XXXII

CONSTITUTIONAL DISORDERS AND DISEASES OF METABOLISM

IN discussing the utilisation of health resorts in different diseases and morbid conditions, some general plan is necessary, though a certain amount of repetition is unavoidable. In the following pages we will commence with various disordered conditions of the general health and affections of the metabolic functions, and then proceed to systems and organs. It will be found that pulmonary tuberculosis has been placed together with other tuberculous affections (Chapter XXXIII) before chronic bronchitis and non-tuberculous affections of the respiratory organs (Chapter XXXIV). Our arrangement is not, however, to be regarded as a strictly methodical one; we have only endeavoured to make it as convenient for our purposes as any classification can be. It must, moreover, always be kept in mind that it is not merely the disease from which the patient is suffering which has to be considered, but likewise, and even more so, the patient himself, his constitution, habits of living, and his peculiarities.

CONVALESCENCE FROM ACUTE DISEASES

There are few conditions for which climatic health resorts are more often visited than for conditions of weakness and imperfect recovery after acute diseases. In some cases, indeed, recovery may be rapid, but even then it is nearly always advisable to prevent the patient from returning to his ordinary work and mode of life immediately.¹ A prolonged period of rest amidst healthy surroundings is, however, absolutely required when convalescence

¹ This is sometimes very difficult, since what may be called the vital or recuperative 'rebound' on the part of the organism after an infectious disease often makes the patient feel particularly lively and vigorous and often gives him a good appetite (a 'convalescent appetite' is notorious) and temporarily increased powers of digestion and assimilation. This 'rebound,' when it occurs, on recovery from an infection is nothing else than an expression of the reaction of the organism against the pathogenic agent, which reaction after it has had the satisfactory effect of overcoming the invading microbes (at the same time doubtless ridding the organism of a great deal of useless or waste material) shows itself by temporary increased power of assimilation &c. Such a satisfactory condition of convalescence should certainly not be interfered with by a too early return to mental work or confinement in stuffy office rooms.

is delayed. In such conditions there may be a feeling of lassitude with inability for any concentration of thought, and a tendency to irritability of temper from the slightest cause; the least physical exertion may increase the pulse frequently from 60 or 70 to 100 or much more in the minute. In many patients a stay in some country district, with pure air, amidst cheerful social surroundings, is all that is required. Individual circumstances have frequently, however, to be taken into consideration. In many cases ocean voyages, or (especially in children) a stay at a fairly bracing seaside health resort, may be recommended; but the patient may be unsuited for sea air owing to a tendency to eczema,*gout, biliousness, and gastric disturbance; and in any case the time of year must make a difference in one's choice. Of inland summer resorts, fairly sheltered places of moderate elevation are generally preferable to those of high elevation; during the hot months of the year, it is important that there should be neighbouring forests, the shade of which will enable patients to remain in the open air during the heat of the day. In spring and autumn inland health resorts of low or slight elevation (the summer climate of which would be rather too hot) may be selected. Many of these places are situated on the borders of inland lakes, such as the large lakes of Switzerland and Italy, and (though rather colder) the lake districts of England and Ireland (Killarney), where the beautiful surrounding scenery exercises a most beneficial effect on the patient's mind. During winter one of the warmer and more equable seaside health resorts, such as those in the south-west of England and in the south-west of France (Biarritz, St. Jean-de-Luz), and those on the Riviera and Austrian Adriatic (Abbazia) and other Mediterranean coasts, may be selected, according to the constitution, the inclinations, and the financial means of the patient.

At seaside resorts during summer, sea-bathing may be of use for the robust class of patients, but great care should be observed. For weaker patients baths of warm sea-water, analogous to the brine baths ('Soolbäder') of inland health resorts, may be employed. The judicious use of hydrotherapeutic methods (cold or tepid douches, &c.) in some cases may likewise have a most beneficial tonic influence.

Mineral water health resorts may sometimes be made use of. Thus, when there is a tendency to cardiac weakness, natural tepid effervescent baths, like those of Oeynhausen and Nauheim, owing to their reflex effect by stimulation of the skin, are likely to be of use. In many cases, especially in weakly children, ordinary brine baths have a decidedly strengthening effect. In recovery from localised peritonitis and after inflammatory affections of the pelvic viscera a course of simple thermal baths exercises not rarely

a curative influence. Thus the baths of Plombières have been especially advocated in chronic pain &c. following appendicitis, and likewise during convalescence from this affection, whether an operation has been performed or not. The hot local and general baths of mud and peat, which can now be obtained at very many health resorts of Europe, sometimes give relief in convalescence from various diseases associated with neuralgic troubles.

The internal use of mineral waters is also occasionally indicated. Thus, when there is a tendency to anæmia, a course of treatment at chalybeate spas may be advised, such as Spa, in Belgium; Schwalbach, in the Taunus; Pyrmont, in Waldeck, &c.; or when a high altitude is required, St. Moritz, in the Engadine. In convalescence from attacks of bronchitis, when there is a tendency to chronicity of the bronchial disturbance, benefit may sometimes be obtained by a course of muriated alkaline waters at Ems, in Germany, at Royat, in the Auvergne Mountains, or at Gleichenberg, in Styria, &c.; sometimes health resorts with sulphur waters, such as Faux-Bonnes and other places in the Pyrenean valleys, act equally well or better. The tendency to constipation found in many convalescent patients may be relieved by the occasional use of aperient mineral waters as well as by ordinary pharmaceutical remedies; but in some of these cases a course at one of the health resorts with muriated mineral waters, such as Kissingen and Homburg, will prevent constipation and promote diuresis and the removal of waste products.

Convalescents, to whatever health resort they are sent, must observe special precautions; they must avoid mental and bodily fatigue, great heat, great cold, and violent winds; they must be careful in their diet, keep their bowels open, wear warm clothing, and attend to the functions of the skin. Suitable recreation should be provided if possible, and an interesting occupation or 'hobby' prevents undue impatience and mental depression.

ANÆMIA AND GENERAL DEBILITY

Chlorosis we consider as a variety of anæmia occurring in females, arising probably from a temporary disorder of the hæmatopoietic functions connected with the development of the sexual organs; according to J. Lorrain Smith's researches,¹ the

¹ *Transactions Pathological Society of London*, 1900, vol. li. p. 314. In regard to the influence of sex in chlorosis see E. Lloyd Jones, *Chlorosis, the Special Anæmia of Young Women*, London, 1897. The characteristic blood-changes of chlorosis seem also occasionally to occur in boys, though almost only in a minor degree.

volume of the blood is increased in chlorosis and the total capacity for absorbing oxygen remains about normal, whereas in pernicious anæmia the condition is more like the anæmia from hæmorrhage, and the capacity for taking up oxygen is much diminished. In most cases rational home treatment, with attention to rest in the open air, suitable diet, the proper action of the bowels, and the administration of suitable preparations of iron, is quite sufficient without the aid of special climates or health resorts. In severe cases, moreover, the weakness may be so great that any exertion, even a short journey to a health resort, is injurious. In very mild cases a visit during summer to mountain resorts of tolerably high altitude is often useful. If it be allowed that (as seems probable) in such mild cases, though the blood is somewhat watery (hydræmia), the total amount is more than up to the average, the dry air of high altitudes may be supposed to exert a beneficial effect by increasing the evaporation from the lungs and skin and thus rendering the blood more concentrated. The number of red blood cells passing through the capillaries of the lungs in a given time would then be increased, and the oxygenation of the whole body would be promoted and the metabolic processes favoured.

No climate, however, is specific against chlorosis; it may occur everywhere. When the constitution is fairly strong, tonic inland climates seem generally to act better than the warm moist seaside climates, which latter often seem to exert a relaxing effect. In the equable and rather humid seaside climates of the south and south-west of England cases of chlorosis seem to be as abundant as anywhere, and Dr. G. A. Leon, of Sidmouth ('Journal of Balneology and Climatology,' London, January 1900) has no doubt that this complaint amongst young girls is particularly common in Devonshire valleys. For *typical* chlorosis, however, seaside places, whether of the equable and sedative or of the more stimulating class, should seldom, if ever, be given the preference over suitable inland resorts.

There are some chlorotics who do not bear the ordinary pharmaceutical preparations of iron well, but can take chalybeate mineral waters with advantage. In such cases Spa, Pyrmont, Schwalbach, and other health resorts with gaseous chalybeate springs are often useful. In other cases spas like Homburg and Kissingen answer better, owing to the waters containing common salt as well as a certain amount of bicarbonate of iron. Spas with muriated alkaline chalybeate waters, like Royat, with its tonic climate, in the Auvergne, are sometimes serviceable, and waters containing arsenic in association with sulphate of iron (Levico and Roncesgno, in Southern Tirol) may likewise occasionally be

prescribed. In very mild cases high altitude resorts with gaseous bicarbonate of iron waters, such as St. Moritz, in Switzerland, and Santa Catarina, in the Italian Alps, often do good. When there is much constipation pharmaceutical laxatives or aperient mineral waters can be used simultaneously.

Cheerfulness of surroundings is very important in the treatment of chlorotics, for a condition of mental depression is sometimes the determining cause of the chlorosis, and cure not rarely follows removal of the depression. Amongst cases of anæmia it is perhaps the chlorotic class in which most supervision has to be exercised in regard to the avoidance of fatigue. Here the influence of the doctor resident at the health resort must make itself felt, for chlorotic patients and their friends have often a firm belief that any amount of exercise in the pure open air must necessarily do them good. It is owing to this wrong impression and the absence of medical supervision that these patients frequently come back from health resorts or from a stay in the country rather worse than when they started.

Besides the ordinary form of chlorosis there are other anæmic conditions which when noted in young females may be incorrectly included under the same heading. In some of these cases the anæmia seems to be due to a structural or merely functional permanent or transitory defect in the development of various organs. Virchow's cases with hypoplasia of the arterial trunks may be classed in this group, and various forms of congenital or 'developmental' **hypoplasia of the vascular system**; in other cases there may be hypoplasia of the sexual organs, and perhaps hypoplasia of the bone marrow. In these cases the nutrition of the whole body must be favoured by general hygienic methods, and the earlier in life that the treatment be instituted the more likely is it to lead to a gradual improvement. Good food, plenty of fresh air and sunlight, cheerful surroundings and regulated exercise are necessary. Tonic climates and bracing sea air, according to the general powers of resistance, are indicated during childhood, and likewise the habitual use of tonic hydrotherapeutic measures such as a cool douche and friction after a short tepid morning bath. Health resorts with muriated or chalybeate waters can be likewise sometimes recommended. In this class of cases the structural defect in development need not necessarily be permanent, and under these methods of treatment the anæmic condition may gradually pass off, either when further local development takes place, or when the defective condition becomes in some way compensated.

Other Cases of Anæmia and General Debility.—In all cases the cause or causes must, as far as possible, be determined and

removed. Cases of anæmia from direct loss of blood through surgical operations or accidents, when the first danger is over, if there be no complications, usually tend to rapid recovery through rest and ordinary home treatment. Sometimes a change from town to country air is advisable, and sometimes a course of chalybeate waters at a pleasant inland health resort of slight elevation amidst beautiful hills and woods, such as Spa, in the Belgian Ardennes, and Schwalbach, in the Taunus Mountains, and Pyrmont, in the Principality of Waldeck, in Northern Germany, may be substituted for pharmaceutical iron preparations. In cases of anæmia due to chronic purulent and mucopurulent discharges the cause must of course be remedied by suitable local or other treatment if possible, but chalybeate waters or iron preparations are generally useful. In these cases climatic health resorts and spas are often beneficial, and must be selected according to the constitution and individual peculiarities of the patient.

Anæmia is often the result of sluggish portal circulation and constipation, associated with hæmorrhoids and congestion of the pelvic organs. In these cases a fairly bracing dry climate often acts well, and inland health resorts of moderate altitude may be selected. Seaside resorts and ocean voyages are generally to be avoided. Mineral water health resorts are useful; one of the common salt waters containing iron, such as Kissingen and Homburg, or one of the cold sulphated alkaline waters containing iron, such as some of the springs at Tarasp, Franzensbad, and Elster, are generally better than pure chalybeate waters, such as Spa and Schwalbach, or the sulphate of iron and arsenic group (such as Levico). In spite of the well-known action of sulphuretted hydrogen on the hæmoglobin value of the blood, sulphur waters, such as Nenndorf and Weilbach, have a great reputation in anæmia connected with hæmorrhoidal hæmorrhages and sluggish portal circulation, and not less so those waters which possess a combination of sulphur and common salt, like Harrogate and Llandrindod (see Chapter XXV in Part II).

Some cases of anæmia and general debility are the result of acute and chronic diseases, neuralgia, mental worry, overwork, nerve shocks, sleeplessness, and inability to take food. Some of these cases have already been considered under the head of Convalescence from Acute Diseases. Others will be considered later on under the head of Neurasthenia ('nervous debility'). Other cases are really due to the wearing out of the vital functions, with or without appreciable structural changes in the organs, and this class will be considered later on under the heading of Old Age and Premature Senility. Other cases are

associated with chronic dyspepsia and chronic gastro-intestinal disorders,¹ and we must refer the reader to these headings; again others are associated with tuberculosis, syphilis, renal affections and chronic malaria, or form part of the results of prolonged residence in tropical climates; and their consideration must necessarily be combined with that of these morbid conditions. With the anæmia and cachexia associated with cancer and other malignant tumours, Hodgkin's disease, lymphadenoma, leukæmia, and with the terminal stages of many other affections, we have nothing to do in this place, nor can we discuss the treatment of advanced cases of pernicious anæmia.

Under the heading **General Debility** there still remain a number of cases in which the patients are neither distinctly anæmic nor cachectic, nor are they neurasthenic in the sense that the debility is more one of the nervous system than of the other systems of the body. Many of these patients belong to the class of originally weak constitutions, in which cold climates and any cold weather increase the disorder. Any attempt to 'feed them up' leads to digestive disturbances and increases the doctor's difficulty. Preparations of iron and chalybeate mineral waters frequently cause headache and constipation, and 'strong' treatment of any kind mostly fails. Even when there is no hereditary tendency and the condition has been acquired in adult life, the causes are frequently altogether obscure. Often the sleep is impaired, and mental depression and irritability—'irritable weakness'²—are apt to be troublesome complications. The general lassitude, disinclination or absolute inability to take any exercise, and anorexia, add to the difficulties of treatment. In all these cases prolonged persistent treatment is necessary, the confidence of the patient must be obtained, and the medical man must not lose patience or hope. Much is to be hoped for by modified open-air treatment with almost complete rest at a suitable inland health resort of slight or moderate elevation (especially in the midst of a large forest) during summer, or at one of the warm seaside health resorts during winter. Simple thermal spas, like Wildbad and Schlangenbad, situated in beautiful woodland valleys, may often be recommended during summer. Massage, or a modified Weir-Mitchell treatment, is sometimes beneficial and may be

¹ These cases, as well as many of the other classes of anæmia to which we have alluded, may be more or less due to chronic toxic influences, such as the absorption from the alimentary tract of the products of abnormal fermentative or putrefactive processes, or the presence of local purulent discharges connected with the teeth, &c. With a view to insuring correct treatment such possible causes should be investigated in all cases of anæmia.

² The nervous centres are abnormally irritable, though they become too rapidly exhausted on exertion.

combined with open-air treatment. The diet and mental state of each patient must be considered individually. As gradual improvement takes place the patient must be encouraged to take voluntary exercise, but a long period is likely to elapse before he can resume his ordinary work or occupation.

The summer and winter health resorts most likely to be useful in the various cases of anæmia have been discussed by Sir H. Weber in the 'Practitioner,'¹ and the following remarks are founded on his summary.

Summer Resorts.—The choice lies principally between the sea coast and more or less elevated localities, which, though of very different elevation, are often for convenience called 'mountain resorts.' This term excludes the low-lying inland places, most of which are not bracing enough for the anæmic, although the cool forests surrounding some of them and the resulting freshness and purity of the air allow exceptions to the rule. The seaside often causes headache, biliousness, loss of appetite, languor, and sleeplessness, while the inland resorts of moderate elevation improve the appetite, the sleep, and the general energy. In a certain number of anæmic patients, however, with fairly good resisting powers, yachting or residence at moderately bracing seaside resorts on the coasts of England, France, and Germany acts beneficially. As recovery takes place in these cases, warm sea-baths, and, later on, in very favourable cases, ordinary sea-bathing may be employed.

Resorts of high altitude, of which there are many in the Alps, are certainly useful in many of the slighter cases of anæmia, and the effect on the blood produced by mountain air has been definitely demonstrated by many observers. The reactive powers of the patients recommended to these climates should be fairly good. Arrangements should generally be made for an anæmic patient to recline in the open air, on verandahs &c. during a good part of the day, and thus spend much more time in the open than he would under the old custom of almost limiting the time spent out-of-doors to that occupied by walking exercise.

Still more useful than high altitude resorts, however, are the numerous localities of slight and medium elevation situated amongst wooded hills and mountains; they suit a greater number of cases, they are more numerous than high altitude resorts, and are found in almost every country. We cannot here stop to discuss the relative merits of the individual health resorts in question.

Winter Resorts.—The winter resorts of high altitudes can only be employed in exceptional cases, because the winter

¹ 'Health Resorts and Waters for the Anæmic,' *Practitioner*, London, 1897.

cold is well borne by only few anæmics. The sheltered localities of the Western Riviera, Abbazia on the Adriatic, the south of Spain (Malaga), and Algiers, offer better chances. Some of the warmer seaside resorts of Great Britain, Ireland, and Western France, especially Biarritz, will likewise answer in certain cases, but, as we have previously stated, they are not generally to be selected in ordinary cases of chlorosis. Localities more or less removed from the seashore often act better than those in the immediate neighbourhood of the sea. Amongst such are Grasse and Cimiez, on the Riviera; Arcachon; Gardone-Riviera and Arco near the Lago di Garda; Rome and Florence; Hajouan, Mena House, and Assouan, in Egypt. As 'intermediate resorts' for autumn and spring, or even as places of residence for the whole winter, sunny places near the Lake of Geneva (as Vevey, Montreux, Les Avants, Glion), many places in the Swiss and Italian lake districts (as Lugano, Locarno, Pallanza) and southern slopes on the Eastern Alps (as Meran, Botzen, and Goerz) can be recommended. Castellammare-di-Stabia and Sorrento on the Bay of Naples, Amalfi on the Bay of Salerno, and La Cava near Salerno, can sometimes also be chosen, so can the beautiful Sicilian resorts of Taormina, Palermo, and Acireale, which, though near the seashore, are more or less elevated above sea-level.

We have already referred to the use of spas with chalybeate waters, or arsenical waters, or muriated waters and baths, in various classes of anæmia; but simple thermal spas are often more useful than any of these places, especially in cases which we have alluded to under the heading of General Debility (with or without obvious anæmia). As good examples of simple thermal spas for such cases we need only mention Gastein, Ragatz, Toplitz, Schlangenbad, Wildbad, and Buxton (in Derbyshire); the pure air and the forests or other pleasant surroundings of such places play doubtless an important part in the therapeutic effects.

Persons in whom anæmia is accompanied by decided dilatation of the heart ought not to be sent either to the high elevations or to the immediate seashore, but to moderately elevated regions (below 3,000 feet) with a fair amount of level or gently rising ground for exercise. These cases also are likely often to derive benefit from effervescent baths, such as the warm salt baths of Nauheim and Oeynhausen. Anæmic conditions following attacks of acute rheumatism can often be treated by these baths, but we will refer further on to the results of acute rheumatism.

Individual peculiarities may sometimes help us in the choice of health resorts, as of ordinary treatment, for anæmic patients. Such patients not rarely present idiosyncrasies in regard to drugs

and foods; their past experiences in regard to the effect of climates (mountain resorts, seaside places, &c.) and mere 'change of air' from one place to another (even when the climates of the two places are apparently similar), their preference for hot or cold weather, and their powers of reaction to hydrotherapeutic measures, should in all cases be inquired into. On this subject see likewise our remarks on the 'Constitution of the Patient' in Chapter XXXI.

In conclusion, we may repeat that arrangement of diet and exact rules as to exercise are of the greatest importance in every case of *anæmia*, and neglect in regard to these matters is likely to render treatment by spas and by climates of no avail. In *anæmic* cases the weakness is often so great that any exertion, and consequently any journey to a health resort, must be injurious. In such cases no attempt should at first be made to remove the patient, but preparatory treatment, by complete rest in the open air, and by being wheeled about in a bath-chair, can usually be carried out at home. The removal of such patients to health resorts should be delayed (often for weeks or months) till considerable improvement has set in, and bad effects from the journey need no longer be feared.

RACHITIC AND WEAKLY CHILDREN

Such children should be brought up in much the same way as children with a predisposition to *scrofula* and tuberculous affections. Though improper feeding more easily produces rickets in some children (weakly children with a tendency to gastrointestinal disorder) than in others, the diet is the most important consideration in every case of rickets. Dry sunny inland climates and warm sheltered seaside localities are the best places for this class of children. Warm brine baths and tepid baths, followed by cool affusions, can be recommended according to the reactive powers. Alkaline earthy chalybeate waters have been recommended for internal use in rickets, but their utility is doubtful.

SYPHILIS

Ordinary cases can be efficiently treated by the usual methods (drugs containing mercury by the mouth, mercurial inunctions and subcutaneous or intramuscular injections, iodide of potassium), and these can never be replaced by climatic or balneo-therapeutic treatment. At every stage of the disease, however, everything possible should be done to improve and maintain the general condition of the patient, but this is especially needful if

syphilis attacks a person already somewhat enfeebled from any cause (overwork, unhealthy occupation, age, alcohol, &c.). When the constitution is vigorous frequent recurrence of local manifestations is less probable. At home much can be done by limitation of brain work, avoidance of mental worry, suitable diet, regular open-air exercise without fatigue, and attention to the skin by baths, frictions, &c. Frequently, however, such precautions cannot be properly observed whilst the patient is at home and attending to his work. For social reasons, moreover, the patient sometimes wishes to be away from home, mainly in order to escape from his friends and ordinary surroundings. In these cases a good health resort offers the following advantages: freedom from the ordinary business and social cares of daily life; freedom from the special worry of remaining at home whilst suffering from a secondary eruption on the face and an infectious condition of the mouth and throat; good air, suitable exercise, and proper diet, without necessity to hurry over the meals; special facilities for inunctions, baths, and douches, and the care of the skin; and in many instances, last, not least, supervision by medical men who have paid great attention to the subject. Thus it is that many health resorts have obtained a special reputation in the treatment of syphilis. Of these Aachen (Aix-la-Chapelle), in Germany, is perhaps the most generally known, chiefly owing to the work and writings of the local medical men in regard to this disease. But the list of health resorts to which patients repair for syphilis is very large, and includes Bagnères-de-Luchon and Ax-les-Thermes in the Pyrenees, Uriage near Grenoble, Aix-les-Bains in Savoy, Wiesbaden in Germany, and a great number of places with thermal sulphurous or common salt springs. The baths at these places maintain the skin in good condition during treatment, and probably favour the excretion by the kidneys of the specific toxins of the disease. Internal courses of waters likewise help to flush out the body, and probably minimise the deposition of mercury in the tissues. It is possible also that sulphurous waters may help to ward off mercurial enteritis, as suggested by A. Neisser, when taken internally, and that a course of common salt waters favours metabolic processes generally, and therefore also those undergone by the mercury in its passage through the body.

There is another point, however, on which we must lay special stress in regard to the action of health resorts in syphilis. Everyone nowadays admits that *tabes dorsalis* and general paralysis of the insane seldom occur in persons who have not had syphilis; there is equally little doubt that a causal connection frequently exists between syphilis and localised inflammatory changes in the

arch of the aorta, which lead to aneurisms; between syphilis and precocious degenerative changes in the blood-vessels at the base of the brain, and in the coronary arteries of the heart; and between syphilis and certain fibrous changes in the viscera. It seems that the toxins of syphilis circulating in the blood may permanently lower the vitality of the nervous or other tissues in such a way that over-work¹ and other harmful influences, though not sufficient to act injuriously in the case of ordinary persons, lead subsequently, in the case of a few of those who have had syphilis, to the occurrence of atrophic and fibrous changes in various organs. If these views² be correct, as we have every reason to believe they are, it is obviously of great importance during the active stages (primary and secondary) of syphilis to rid the body of the injurious toxins as quickly as possible after they are produced, and thus diminish the length of time during which they exercise their bad effects on the vitality of the various cells. This object is probably best accomplished by the eliminative action, to which we have just alluded, of hydrotherapeutic and balneotherapeutic methods³ employed during the early stages of the disease in association with specific treatment. According to the same theories, an almost equally important indication is to protect syphilitics from over-work and mental worry. This can only be accomplished for some patients by having them treated during the active stages of the disease at some health resort, and by advising them as to the danger of excessive bodily and mental strains, and the value of regular holidays in suitable climates; they must understand that this

¹ Vide the results obtained by Edinger and Helbing from their experiments as to the production of the spinal lesions of tabes dorsalis by forced muscular exercise in animals (German Medical Congress, 1898). See also the 'Discussion on Tabes Dorsalis and General Paralysis, at the Pathological Society of London,' November and December 1899, *Transactions of the Pathological Society*, 1900, vol. li. Cf. Lillenstein, 'Beitrag zur Lehre vom Aufbrauch durch Hyperfunktion,' *Muenchener med. Woch.* 1906, No. 16, p. 748.

² F. P. Weber, 'Der Nutzen von Bädern, Mineral-Wässern, und Kurorten in der Behandlung der Syphilis,' *Abhandl. der 72. Versammlung deutscher Naturforscher und Aerzte*, Aachen, 1900, *Abtheilung für Hautkrankheiten und Syphilis*, p. 259; also *British Physician*, London, June 15, 1900, p. 327.

³ It might possibly be argued that when syphilitic patients are receiving mercurial treatment (which, in the early stages of the disease at all events, may apparently be really considered 'specific' treatment, in the sense that the mercury when taken into the body probably acts directly antagonistically to the living cause of the disease, whether the 'spirochæta pallida' of Schaudinn and Hoffmann is the pathogenic organism in question or not), the simultaneous spa-treatment may lessen the action of the mercury (in the same way that the simultaneous use of potassium iodide is by some authorities supposed to) by accelerating its elimination from the body. But, doubtless, the spa-treatment at the same time hastens the removal of the toxins of the disease and does good in that way, as well as by improving the general health of the patient. Cf. also the introductory portion of Chapter XXV.

advice applies not only to the period when they show obvious signs of the disease, but that the same hygienic mode of life must be continued for many years after every trace of the disease seems to have vanished, or even for the whole life.

Syphilitic Cachexia.—There may be a certain amount of disturbance of the general nutrition associated with syphilis in the earlier stages, but the severer forms of syphilitic cachexia mostly occur at late periods. The cachexia is often accompanied by obvious tertiary syphilitic lesions in the abdominal viscera and other parts of the body, but it may occur without other simultaneous marks of syphilis being present. In cases of syphilitic cachexia the anæmia may be excessive, and the case may resemble one of pernicious anæmia. The ordinary antisymphilitic remedies (by iodide of potassium and mercury) may more or less completely fail, and these cases may, indeed, show themselves very resistant to any mode of treatment, pharmaceutical or otherwise. The hæmatopoietic functions seem to be affected either by the toxins of the disease or by a local syphilitic process affecting the marrow and cancellous tissues of the bones. Suitable climatic health resorts may be of use in such cases. During summer simple thermal or thermal sulphur spas amidst cool woods and in beautiful broad mountain valleys may be tried. The elevation must depend upon individual indications. Ordinary hydrotherapeutic measures, when judiciously carried out, often have a most beneficial influence. Occasionally also iron and arsenic waters may be of use. The winters ought to be spent in warm, dry, sunny climates, such as the Riviera and Egypt, where the diminished powers of resistance towards cold are not overtaxed. The question of the simultaneous use of anti-symphilitic remedies must be specially considered in each patient. Some of the worst cases are too bad for removal to a health resort until a certain amount of improvement has taken place by home treatment. In every case the utmost attention must be paid to the general hygienic management. Thus, at first, more or less complete rest is required, and this indication can be fulfilled by arranging a kind of open-air treatment like that employed for pulmonary tuberculosis. The diet must always be carefully attended to. Improvement will generally be very slow, and the medical man will have to take pains to oppose the patient's tendency to despondency.

CHRONIC METALLIC POISONING

In cases of chronic metallic poisoning from mercury or lead there is no special indication in regard to climate, excepting that whenever there is cachexia the climate should be one which

makes no excessive demands on the patient's resisting powers. Simple thermal waters and weak thermal sulphur waters, used in the form of baths and douches, as well as ordinary hydrotherapeutic methods, may be serviceable in promoting the general nutrition and favouring the elimination of the metallic poisons from the body. Many of the spas with simple thermal waters and sulphur waters are beautifully situated at moderate elevations above sea-level, and form delightful health resorts for summer. Mild internal courses of sulphated alkaline waters, such as Karlsbad, and of other waters with a cholagogue or diuretic and laxative action (including waters containing common salt, such as Harrogate, Llandrindod, Homburg, Kissingen, and Bourbonne-les-Bains), may also, like certain pharmaceutical preparations (potassium iodide), be of use in assisting the removal of the poisons deposited in the liver and other parts of the body, by way of the urinary, biliary and intestinal secretions. Warm, dry winter climates, such as Egypt, would be useful in cases of chronic lead poisoning when the kidneys have become involved.

CHRONIC GOUT AND GOUTY CONDITIONS

In the case of gouty persons, regulation of the diet, great moderation in food (especially the purin-containing foods) and stimulants, and avoidance of all foods and drinks which in the individual patient give rise to any gastro-intestinal disturbance, and regulation in the mode of living—especially the avoidance of factors such as a too sedentary occupation, the impure air of insufficiently ventilated rooms, and mental worry, which are known to favour chronic disorders of the digestive organs and metabolism—are the main matters to be considered; but climates and mineral water health resorts are often useful. As a rule, dry inland health resorts are more suitable than the sea coast and sea voyages. Sea air not rarely induces exacerbations of gouty affections, and it sometimes tends to bring on a condition of biliousness or constipation and drowsiness. It seems in these cases as if the appetite and the first stages of proteid catabolism were increased, whilst the functions of the organs concerned in the later stages of nitrogenous catabolism¹ and with the elimination of waste products remain defective. Sir Dyce Duckworth, however, has seen benefit result from sea voyages in some cases, although the tendency to over-eat and to take insufficient exercise is a disadvantage. In 'strumous' gouty cases he recommends a stay at the seaside for some weeks in each summer, and in older

¹ 'On the Biliousness Sometimes Induced by Sea Air,' by F. Parkes Weber, *Treatment*, London, January 11, 1900.

patients and asthenic forms of gout he finds warm sea-water baths and douches of value.

Inland climates should be selected for gouty patients according to their constitution and reactive powers. Dry climates are better than moist ones. Sheltered resorts of high altitude are often useful in summer for the stronger class of patients without emphysema or cardiac affections. For less robust patients and those with a tendency to emphysema and cardiac dilatation, places at medium elevations with plenty of opportunity for level or only slightly uphill walking should be preferred. In many weak gouty persons mere changes of climate and travelling to interesting places are sufficient. By this means the mind and body of the patient are both kept active, without excessive strain being thrown on any of the functions. In old and debilitated persons and those affected with arterio-sclerosis, warm, dry, winter localities, such as Egypt and the Riviera, should be chosen, especially when the kidneys are already somewhat affected.

A course of treatment at mineral water health resorts during the warmer months of the year is frequently an advantage. Gouty conditions are probably due to a complicated and often hereditary disorder of metabolism in which hepatic inadequacy (Brunton) and derangement of the internal secretion of the thyroid (A. Lorand) and other glands,¹ may play a part. In regard to uric acid and the purin bodies, whatever may be the relative parts played by their excessive intake, abnormal formation by the tissues, and deficient excretion in the production of gouty phenomena, we can easily understand that baths and various hydrotherapeutic processes may be of great use, if not by rendering catabolic processes more perfect, at any rate by aiding the elimination of waste products from the body. Moreover, it has been maintained by various writers that intestinal auto-intoxication or infection is an important factor in the production of gout,² and the clinical observation that aperient mineral waters and

¹ In regard to the relations of the thyroid and sexual glands with metabolism the experiments of Chalmers Watson (British Balneological and Climatological Society, March 7, 1906) are interesting. An excessive meat diet in rats produced amongst other changes (such as chronic catarrhal thickening in the respiratory mucous membranes) alterations in the thyroid gland. The offspring of these rats likewise showed thyroid gland changes, doubtless produced before birth by the meat diet to which the mother was subjected. E. I. Spriggs (Pathological Society of London, December 18, 1906) in discussing Watson's results, suggested that the changes found in the bone and bone-marrow of meat-fed rats might really be the result of deficiency of calcium-salts in their diet.

² See W. R. Gore, 'The Origin of Gout,' *British Medical Journal*, September 29, 1900, p. 898; Woods-Hutchinson, 'The Meaning of Uric Acid and the Urates,' *Lancet*, January 31, 1903, p. 288; Chalmers Watson's 'Observations on the Pathogenesis of Gout,' *British Medical Journal*, January 9, 1904, p. 68; and the section on gout in W. Bain's *Text-book of Medical Practice*, London, 1904.

aperient drugs are often beneficial in the treatment of gouty persons, fits in very well with this view. In regard to internal courses of mineral waters, the sulphated and the sulphated alkaline waters exercise the best effect in robust constitutions with a tendency to obesity and abdominal plethora, especially when there is a tendency to constipation. The sulphated alkaline waters, the simple alkaline waters, and the alkaline earthy waters¹ (Contrexéville) are recommended when there is a tendency to uric acid deposits in the urine; the sulphated alkaline group particularly in the plethoric cases. In weaker patients the muriated, muriated sulphurous (see also remarks in regard to the action of Harrogate waters in Chapter XXV), and simple thermal waters are of use.² The muriated sulphurous and sulphurous spas (Schinznach, Uriage, Harrogate, &c.) have a reputation in gouty patients with a tendency to eczema; likewise some muriated alkaline spas, such as Royat and La Bourboule. In regard to the carbonic acid gas³ from mineral waters being a possible factor in the production of gouty conditions, we think that carbonic acid is more likely to exercise such an injurious effect when there is *chronic* excess of it in the blood as a result of deficient muscular exercise and confinement in the impure air of badly ventilated rooms.

Active exercise, according to the patient's state, is of great importance in all cases. It is quite obvious, indeed, that exercise in the open air is likely to be of the greatest use in a disease the symptoms of which are connected with defective processes of

¹ Here we may allude to a possible influence of calcareous salts on the metabolism and their effect in some cases of reducing the secretion of uric acid in the urine (H. Kionka, Noorden, &c.) [see also Chapter XXVI]. In regard to the action of alkaline waters Kionka's experiments ('Die Wirkungen der alkalischen Mineralquellen,' *Medicinische Woche*, 1904, No. 9) are interesting. He found that hens fed on a meat diet die within three months, but that if in addition to the meat diet they are given sodium carbonate, magnesium carbonate, calcium carbonate or common salt in quantities such as occur in mineral springs, they can be kept five or six months in good condition, and then (if killed) do not show in their kidneys, liver or joints the severe lesions ('artificial gout') which hens fed on meat diet ordinarily do.

² In regard to the solvent action of mineral waters on gouty deposits, W. Bain (*Brit. Med. Journ.* 1899, vol. i. p. 1392) gives a table showing the solubility of sodium biurate at a temperature of 38° C. in 100 c.cm. of artificial blood-serum, and in artificial blood-serum containing 1 per cent. of various mineral waters. He points out that the differences in solvent power between the various waters (some of those he employed, as the Homburg Elisabethenbrunnen and the Kissingen Rakoczzyquelle, contained a fair amount of sodium chloride) are almost infinitesimal, and that in any case the differences in question are not necessarily determined by the percentage of sodium salts contained. He allows, however, that the value of a supposed biurate solvent cannot be estimated by mere test-tube experiments.

³ Cf. D. F. Shearer, 'Carbonic Acid as a Factor in the Genesis of the Gouty Condition,' *Lancet*, February 11, 1905, p. 349. Carbonic acid has been supposed to exercise an antagonistic influence on the development of tuberculous lesions.

oxidation in the body. When sufficient exercise is impossible, massage may to some extent supply its place, but voluntary exercise increases the processes of oxidation in the muscles more than massage does, and by increasing the respiratory movements it brings about a gentle intermittent squeezing of the abdominal viscera, and thus doubtless favours the functional activity of the liver and intestines.

ARTICULAR RHEUMATISM

Rheumatism is a very vague term, and is frequently used to include a number of different morbid conditions. We shall first consider the treatment to be followed during convalescence from acute rheumatism (rheumatic fever). It may be said that the nearer a person is to a previous attack of the disease, and the younger the individual, the more easily a fresh attack may be brought on by imprudent management. Exposure to cold, especially to damp cold, and to impure air may lead to an attack of follicular tonsillitis, followed by a return of acute articular or cardiac manifestations. Digestive disturbances, due to dietetic errors, may have a similar result. The heart may be affected without there being any distinct physical signs of heart disease, yet premature exertion may lead to yielding of the inflamed and softened cardiac valves, and to permanent valvular disease. Douglas Powell¹ thinks that mitral stenosis and aortic regurgitation are valvular lesions which are scarcely ever met with in the initial rheumatic illnesses, but that they are the consequence of subsequent slow deforming valvulitis from strain put upon the valves before they have completely recovered from the primary rheumatic lesion. S. Solis Cohen,² who believes that the heart muscle is often involved, has drawn attention to the danger of chronic myocardial trouble following acute rheumatism as a result of premature return to ordinary activity. All this makes it obvious that prolonged rest (rest in bed) is of the first importance, not only during the active stages of the disease, but for a considerable period afterwards. After sufficient time, however, has been allowed for this complete rest, a change of climate is often advisable before the patient is allowed to resume an ordinary mode of life. During summer a dry sheltered locality of medium elevation, not too hot and not too cold, will be suitable; and during winter a warm dry climate, such as the Western Riviera or Egypt. If the convalescence is very slow, and if, in spite

¹ *Lancet*, March 31, 1900, p. 922; see also R. Caton, 'On the Prevention of Valvular Disease in Acute Rheumatism,' *Brit. Med. Journ.* October 20, 1900, p. 1156.

² *Journal of the American Medical Association*, January 12, 1901, quoted in Cohen's 'System of Physiologic Therapeutics,' vol. iv. p. 287.

of prolonged rest, the heart remains weak and irritable, with or without valvular complications, a course of treatment by thermal effervescent baths, such as those of Nauheim, may be recommended; the treatment should be carried out in a suitable climate, either with baths of a natural effervescent mineral water or an artificial substitute, but in every case under careful medical supervision. Afterwards the patient may stay at a climatic resort of the kind already referred to.

When, in regard to the general condition, recovery is good and the heart appears to be quite free, but the joints remain more or less stiff and swollen, a course of treatment at simple thermal spas or, at brine spas will mostly do good, the baths being in some cases aided in their action by douches, massage, passive movements of joints, and Swedish gymnastics.

CHRONIC ARTICULAR RHEUMATISM.—A great deal of what was formerly termed chronic articular rheumatism is now classed as chronic rheumatoid arthritis, and some cases belong to the 'pseudo-rheumatic' affections; yet there are cases left which are probably of the same nature as acute rheumatism from a pathological point of view, though they are chronic instead of acute or sub-acute. Acute rheumatism is now generally supposed to be a specific disease (though probably predisposed to by constitutional and metabolic factors), but until it is absolutely settled what the organisms are which should be regarded as the essential cause of that disease, the question of the pathogenic identity of the chronic with the acute forms of 'articular rheumatism' cannot finally be decided. The treatment will be similar to that of the chronic and convalescent stages of acute articular rheumatism, to which we have referred in the preceding paragraphs.

GNORRRHŒAL RHEUMATISM, AND OTHER PSEUDO-RHEUMATIC AFFECTIONS OF THE JOINTS AND FASCIÆ

Gonorrhœal rheumatism may be taken as the type of this group, but there are doubtless various septic processes in the body (for instance, non-gonorrhœal forms of urethritis) and toxic conditions of the blood which may induce similar disorders of the joints and fasciæ independently of gonorrhœa. The exciting causes of the complaint must of course be treated by the ordinary methods. For the part which can be played by climates and health resorts in the removal of gonorrhœal gleet we must refer to Chapter XXXVII under the heading 'Chronic Urethritis.' Swelling, tenderness, and partial fixation owing to inflammatory exudation about the joints and tendons, are apt to be more persistent in these affections than after acute rheumatism.

Benefit may therefore be derived from a great number of health resorts where treatment can be obtained by thermal baths, douches, douche massage, massage, passive movements, Swedish gymnastics, and sometimes by the local application of hot muds (including the 'fango' of North Italian spas) or hot sand, or by local vapour baths, local hot air baths, and local electric light ('radiant heat') baths. Similar climates may be chosen to those recommended after acute rheumatism.

CHRONIC RHEUMATOID ARTHRITIS

We will not enter on the vexed question of the pathogenesis of rheumatoid arthritis, whether it is related to gout, and whether it is a single disease or a group comprising ætiologically distinct conditions. The term was first employed by Sir A. B. Garrod in 1858, but many other terms have been, and still are, employed to denote the same clinical group of cases; amongst them may be mentioned chronic rheumatic arthritis, rheumatic gout, arthritis or polyarthritis deformans (Virchow), and osteo-arthritis (the favourite term amongst the surgeons of England). In regard to treatment cases may be roughly (not sharply) divided into two groups: Firstly, a multiple affection of the joints (articular and periarticular), more or less active, though generally chronic in duration, and occurring in comparatively young and middle-aged persons; secondly, an affection generally occurring in debilitated old persons, less active and more atrophic in its manifestations. In old persons one of the bigger joints is often singled out (as, for instance, in senile hip disease, 'morbus coxæ senilis'), especially when some injury seems to have brought on the disease.

In the first class of cases dry tonic climates of moderate elevation, where the soil is porous, dry, and well drained, are to be recommended for residence. During summer, health resorts where thermal baths (simple thermal, thermal sulphur, or thermal muriated waters) can be obtained are often useful; of frequent use also is the local or general treatment by hot mud baths, hot peat baths, hot vapour baths, and hot air baths (electric light baths included).

In the second class of cases the treatment must naturally be adapted to the relatively senile or debilitated character of the patients. Simple thermal spas in pleasant mountain valleys may, however, be useful, and occasionally an internal course of muriated or muriated alkaline mineral waters may be recommended. When the affection is nearly limited to one joint, local hot vapour, air or mud baths can be employed. In winter, warm, sunny, dry localities should be selected owing to the limited powers of resist-

ance to cold in this class of patients. Sea voyages in warm climates, such as in the Mediterranean or to the West Indies, are sometimes to be preferred when a patient's inclinations lie in this direction. The arrangement of a simple but nourishing diet is required, according to individual indications. The uses of mere change of locality &c. will be referred to again when we consider the climatic treatment of old age.

CHRONIC OR PROGRESSIVE ARTHRITIS OSSIFICANS

Arthritis ossificans has been much talked of during recent years, and has some claim to be regarded as a distinct affection. When the vertebral column only is affected, the disease is often spoken of as spondylitis deformans (chronic ossifying spondylitis) or rheumatoid arthritis of the vertebral column, but it differs considerably, both in its clinical and anatomical-pathological characteristics, from ordinary rheumatoid arthritis. The French (Pierre Marie) have termed the disease 'Spondylose Rhizomélique' when it affects the extremities (notably the hip-joints) as well as the vertebral column; it may sometimes progress to almost universal bony ankylosis. The treatment is as uncertain as is its etiology, and the course of the malady seems generally a progressive one, as some of the names invented for it imply. In early cases a simple nourishing diet combined with courses of hot baths or douche massage, such as may be obtained at Aix-les-Bains, Bath, Wiesbaden, Baden-Baden, and other spas, and winter residence in warm, dry localities, would seem to offer the best chances for improvement.

CHRONIC ARTICULAR AFFECTIONS OF TRAUMATIC ORIGIN

In joint cases, apparently following injury, when the pains, stiffness or swelling become chronic in spite of ordinary measures, there is often a constitutional factor present, and treatment by hydrotherapy &c. at health resorts for chronic gouty and rheumatic conditions is frequently beneficial. Care must of course be taken to distinguish tuberculous and hæmophilic affections of the joints following injury. Other cases are really only examples of rheumatoid arthritis more or less limited to a single articulation. At most health resorts the chronic results of injuries are generally treated by some kind of local application of heat, with or without massage and systematic movements. We may instance the methods of hot douching as carried out at Bourbonne-les-Bains, &c., the alternating or 'Scotch' douche, the Aix douche-massage, local hot mud baths (Acqui, Battaglia), hot sand baths, and local

hot vapour or hot air baths, including the various forms of electric light and 'radiant heat' baths. In monarticular cases with synovial effusion the use of brine packs during the night is sometimes useful.¹ In regard to the resolution of articular and peri-articular adhesions by sodium chloride applications and electrolytic methods, see S. Leduc's article already referred to ('*Presse Médicale*,' Paris, Sept. 22, 1906).

CHRONIC MUSCULAR RHEUMATISM, LUMBAGO, RHEUMATIC MYOSITIS, 'FIBROSITIS'

The pathological anatomy of muscular rheumatism is by no means clear, and naturally so, since the affection is never fatal in itself. Some cases are associated with osteo-arthritis and others with gout. Sometimes the trouble may really be a referred pain, due to what may be termed 'irradiation,' and the cause of the pain may lie in some osteo-arthritic or other affection of a shoulder, hip, or intervertebral joint, though the case be spoken of as sciatica, lumbago, &c. In other cases the pains complained of may be due to a partial neuritis of some nerve trunk or its branches (see sections on Neuritis, Sciatica &c. in Chapter XXXIX). In still other cases, especially in certain forms of lumbago, the pains may have originated in the rupture of partially degenerate muscular fibres or of the interstitial tissues, resulting from some slight strain or violence, probably not sufficient to have injured perfectly healthy muscles. Sir W. R. Gowers' views on what he calls 'fibrositis'² have done much to illuminate the whole subject.

In chronic muscular rheumatism treatment by hot general baths may be employed, and can be freely assisted by douches. In many instances internal courses are required to assist the treatment by baths, according to the nature of the complications, such as dyspepsia, constipation, or the uric acid diathesis. For after-treatment it is necessary to select dry and sunny localities, at moderate elevations if possible, on the southern or western slopes or terraces of mountains. Certain localised pains having their seat in the muscles, or partly in the muscles and fibrous tissues, partly in the nerves, sometimes associated with indurated tender spots,³ and termed 'chronic rheumatic myositis' (compare the views of Sir W. R. Gowers on fibrositis, *loc. cit.*), can be much benefited by massage, local hot-water baths and compresses, local baths of hot peat, mud or 'fango,' or local hot air or vapour baths of various kinds, with or without accompanying internal or climatic treatment.

¹ See J. Hutchinson, *Polyclinic*, January 1902, p. 45.

² See 'Lumbago, its Lessons and Analogues,' *British Medical Journal*, January 16, 1904, p. 117.

³ See H. Strauss, *Berliner klinische Wochenschrift*, 1898, Nos. 5 and 6. See also the paper of Von Steinbüchel, of Gratz, at the *Versammlung deutscher Naturforscher und Aerzte*, München, September 1899 (*Münchener med. Wochenschrift*, 1899, No. 44, p. 1478). Cf. G. Norström's *Handbook of Massage*, New York, 1896.

OBESITY

In the treatment of obesity climate is not very important. Reduction of fat may be indicated not only in cases of excessive obesity, but also, at times, when a lesser degree of fatness complicates chronic cases of bronchitis, cardiac or renal disease, or cases of chronic rheumatism or gout. It must not be supposed that all fat people eat an amount that for ordinary individuals would be excessive or that they are particularly lazy; individual peculiarities in the metabolic processes (often hereditary) play a very important part in the production of obesity; some persons remain relatively thin however much they eat and however little exercise they take, whereas in others 'all the food they take seems to turn into fat.' Nevertheless, the main treatment of obesity resolves itself into a question of diet and exercise. The aim of dietetic treatment must be to reduce the amount of fat-forming foods so as to make the body burn up its superfluous fat without being unduly weakened by excessive oxidation of its proteid components—that is to say, the burning up of the fatty tissues of the body must be excessive, whilst an equilibrium of income and output in regard to the proteid metabolism is maintained. Great reduction in the amount of food taken is, of course, specially indicated in the plethoric type of obesity occurring in persons whose intake is obviously excessive and in whom the condition has developed in spite of plenty of open air exercise. Into the details of dietetic treatment, however, we cannot enter here.

The climate should be of a fairly cold and dry (bracing) kind, so that, owing to the necessity for greater heat production, the metabolic processes may be increased, and that a mental inclination for muscular exercise may be induced. In most cases, bracing inland resorts of high elevation, if the heart, blood-vessels, and kidneys are not affected, are better than sea air and ocean voyages. Mineral water health resorts may aid the dietetic treatment in some cases. In regard to the action of mineral waters and baths in these cases it must be remembered that the removal of a large amount of the patient's fat is not the only object to be aimed at; but his general health must be maintained whilst the reduction of fat is being effected by diet, exercise, and other means. Even when the patient's weight cannot be much or quickly reduced, it is most important to keep his organs in a state of healthy activity, for the accumulation of fat hampers the action of the heart and the movements of respiration, and favours sluggishness generally. Sulphated and sulphated alkaline waters taken internally may be useful by their action on the bowels and by their

diuretic effect. Marienbad has a special reputation in cases of obesity, partly due, doubtless, to the attention paid by the doctors to diet and general regimen. Hot-air and vapour baths, by their action on the skin, have a powerful eliminative effect, and make some fat persons feel healthier and more inclined to be active and to take exercise, but by themselves they are not an efficient method of counteracting obesity.¹ Cold hydrotherapeutic treatment, combined or not with hot-air baths, is useful by increasing the processes of metabolism in the body. In this connection it is interesting to note that the reaction consequent on general cold hydrotherapeutic procedures is accompanied, as Winternitz and his pupils, Strasser and Wertheimer, have shown, by a temporary increase in the red and white cells and in the specific gravity of the circulating blood, great numbers of cells which were stagnating in the abdominal viscera and elsewhere being, doubtless, washed out by the stronger blood stream into the circulation. One of the immediate results of cold-water treatment is, therefore, that the tissues are supplied with blood containing more hæmoglobin and more oxygen, and in this way, as long at least as the period of reaction lasts, processes of oxidation are specially favoured. The same may, of course, be said in regard to active muscular exercise, abdominal massage, and other procedures which temporarily increase the proportion of red cells in the circulating blood. Thermal effervescent baths may be employed when there is a tendency to cardiac weakness. The iron contained in some sulphated alkaline and muriated waters serves to counteract anæmia when this complicates obesity.

It must not be forgotten that the accumulation of fat may in some persons, probably generally of arthritic families, follow severe illnesses, such as typhoid fever, or severe mental shocks and mental trouble; in some of these cases the obesity is only temporary, and disappears with the improvement of the general health, which may be furthered by climatic and balneotherapeutic treatment, according to individual indications. To the subject of obesity and plethora occurring at the climacteric period in women we shall return in a later section under the heading 'Climacteric Period in Women.' In conclusion, we must refer to the value of pure air and sunlight as obtained at good health resorts, in promoting oxidation in the tissues (when combined with suitable exercise, &c.), and thus helping to burn up superfluous fat. Thyroid treatment may doubtless in some cases be advantageously combined with residence at health resorts under medical supervision.

¹ Cf. M. Altdorfer, 'Some Theoretical and Practical Remarks on the Hot Air Bath,' *Dublin Journal of Medical Science*, August, 1899.

DIABETES MELLITUS AND GLYCOSURIA

For present purposes we may divide our cases into, firstly, the grave forms of diabetes, which occur especially in young persons, and generally run a progressive, often rapid, downward course; the acute forms are associated with the passage of large quantities of urine of high specific gravity and considerable percentage of sugar, excessive thirst, dryness of the skin, and emaciation; secondly, the so-called benign forms, in gouty or stout persons, mostly well advanced in the second half of life. No hard-and-fast line, however, separates these two classes from each other. Cases of benign diabetes, apparently non-progressive in character, may, under the influence of mental worry, over-work, and improper diet, be suddenly transformed into very grave cases; temporary cases of slight glycosuria, due to alimentary causes or to nerve shocks, &c., may later on become well-marked cases of diabetes mellitus. We need not here enter into a discussion as to which cases of temporary glycosuria due to alimentary and other causes should be regarded as very slight or commencing forms of true diabetes, and which should be termed examples of 'non-diabetic glycosuria.' The mere question of the term to be employed does not affect the prognosis or treatment of the case.

Theoretically, of course, all cases in which sugar appears in the urine may be divided into various pathological groups, accordingly as the pancreas, the liver, the nervous system &c. are supposed to be 'structurally or merely functionally' at fault. In some cases, it is true, this classification may be of use in regard to prognosis or treatment—for instance, when it is recognised that the glycosuria is dependent on an injury to the brain or on a pancreatic concretion; but clinically, cases in which such diagnoses can be made are rare. Much, however, that is of practical importance in regard to treatment and prognosis can be made out by clinical observation. For instance, it may be ascertained whether with a suitable diet sugar readily disappears from the urine, or whether the sugar is usually absent from the urine and only appears there under exceptional circumstances (for instance, when excess of carbohydrates is taken as food—'alimentary glycosuria'), or whether dietetic treatment fails to free the urine of sugar; by clinical observation one may discover what special articles of diet (and what amount of them) cause the passage of sugar in the urine, or increase the quantity of sugar passed, and whether the patient has other affections in addition to the diabetes, such as renal disease, gout, or pulmonary tuberculosis.

Grave Cases.—For grave cases in young persons there are no special climatic indications, excepting that the climate must

not be a very severe one which makes excessive demands upon the patient's powers of reaction. Holidays, however, and a change of air are often advisable, and for this purpose suitable climates should be chosen according to the season of the year, &c. Thus a visit to the Riviera may be made during winter, and to some quiet and beautiful mountain valley of moderate elevation during summer. It is in this class of cases that over-exertion (including fatiguing railway journeys and wearisome mental work), excessive excitement, and shocks should be especially avoided, as being frequent causes of a fatal termination by diabetic coma (though alkaline treatment is to some extent prophylactic). All causes of anxiety ought to be removed and cheerful influences promoted.

In some of these cases a visit to a summer health resort may be combined with a stay at some private sanatorium, where the metabolic failings can be thoroughly investigated and the kind of diet can be discovered which is most suitable for the patient at the period of the disease in question; in this way, moreover, the habit of taking the right kind of foods can be acquired.

Mild Cases.—In the more chronic and benign forms of the disease likewise, a stay in a sanatorium at some health resort can be made for the purpose just mentioned. The management of diet, the attention to muscular exercise, and the regimen in general must be attended to wherever the patient is, and it is doubtless partly owing to attention to these points that certain mineral water health resorts, such as Vichy, Neuenahr, and Karlsbad have obtained their reputation. 'Benign' cases of diabetes are often, as we have already observed, made worse by mental over-work, worry, and nervous shocks. Exacerbations of this kind can often be avoided by changes of climate and mental relaxation, if recommended at the proper time, and the exacerbations themselves often rapidly improve (under suitable diet) when mental worry or other cause of the exacerbation has been removed. It is for this reason that a long sea voyage, with the resulting freedom from business worries, &c., is likely to be useful; a voyage is the easiest method by which letter-writing and ordinary correspondence can be reduced to a minimum. Frequent changes of climate and locality have likewise a very beneficial mental effect in some persons, and may be recommended provided that a suitable diet can be obtained. Thus, visits to famous towns of historic interest are often useful; but fatigue in travelling should be as far as possible avoided in all cases. The climates selected for a visit must depend upon the season of the year and individual indications. During summer the bracing effect of elevated mountain and forest regions is often to be preferred, and dry, warm, sunny localities may be visited during

winter. Thus, during winter Europeans may spend their time in leisurely yachting in the Mediterranean, or they may stay at one of the health resorts on the Riviera or in Sicily; they may visit Rome, Greece, or Egypt, and in the last instance make a voyage up the Nile. A well-arranged visit to India is likewise often beneficial. It must, however, be added that many glycosuric patients with sound circulatory systems derive most benefit also during winter from mountain climates and the active habits developed there. Turban thinks that in high altitudes the diet need not be quite as strict as in low altitudes; that is to say, as far as can be judged by the amount of sugar got rid of in the urine. •

In our second class of cases a course at a mineral water health resort during summer is sometimes useful. The mineral water chosen must depend upon the constitution of the patient: whether he has a gouty tendency, a tendency to piles and abdominal plethora; whether he has been accustomed to indulgence in excessive food and drink; and whether he is spare in body or inclined to obesity. In cases of 'gouty glycosuria' and fat persons attacks of uric acid gravel sometimes alternate with the glycosuria, and a small quantity of albumen is not infrequently present in the urine. For these patients health resorts with sulphated alkaline and simple alkaline waters may be recommended. Amongst the best known are Karlsbad, Brides-les-Bains, Vichy, and Neuenahr; Contrexéville is frequently recommended in France; and in Great Britain the muriated sulphurous waters of Harrogate and Llandrindod may be used for the same purpose. It is in the 'benign' forms of diabetes and those in which the sugar readily disappears from the urine under anti-diabetic diet that muscular exercise is especially indicated, partly in order to aid in 'burning up' the sugar. Massage and Swedish gymnastics may accompany spa treatment when sufficient ordinary exercise is not taken owing to fatness or disinclination. For weak and for spare persons simple thermal baths, such as can be obtained at many resorts of moderate elevation (Gastein, Wildbad, Buxton, Schlangenbad, and Ragatz), are beneficial. The internal use of muriated alkaline or simple alkaline waters (Vichy, Neuenahr, Obersalzbrunn, Royat, La Bourboule), in association with thermal baths or alone, may often be recommended.

CHRONIC MALARIAL AFFECTIONS AND CACHECTIC CONDITIONS FROM LONG RESIDENCE IN HOT CLIMATES

Climatic health resorts are frequently of use for persons returning from hot countries, whose health has been impaired

through malaria and other microbic affections, or merely through the enervating effects of long residence in tropical countries, combined with an unsuitable diet and mode of life. In patients suffering from chronic malaria, exposure to damp cold and strong winds will frequently bring on exacerbations of the disease even in non-malarious countries. In such cases, when the powers of reaction are good, long residence away from malarious districts, at resorts of high altitude, especially in the neighbourhood of glaciers, generally gives satisfactory results. Quinine and arsenic must often be employed, however, as well as climatic treatment. If attacks of malaria are, as has been asserted, associated with and favoured by an excess of water in the blood (hydræmic condition),¹ it is easy to believe that, granting the presence of malarial parasites in the body, damp places and moist climates may favour recurrence of attacks of fever, whilst dry climates (for instance, sheltered mountain resorts of high altitude) may prevent them.

Amongst medical men who have practised in India and other hot climates, Karlsbad, in Bohemia, enjoys a special reputation for most of the disordered states of health which result from malaria and long residence in tropical countries. Courses of treatment at this spa are much employed in malarial cases complicated with enlargement of the spleen and liver, and the results on the general health of the patient are mostly satisfactory, even when no distinct decrease in the size of the enlarged viscera can be made out after treatment. The muriated sulphated waters of Brides-les-Bains, in Savoy, and the sulphated alkaline waters of Tarasp, in the Lower Engadine, and Franzensbad, in Bohemia, may be employed in the same way as those of Karlsbad, and all three places have invigorating climates. In delicate patients simple thermal spas, such as Gastein, in Austria, Wildbad, in the Würtemberg Black Forest, and Plombières, in the Vosges Mountains of France, may be recommended instead of strongly mineralised waters; Buxton, in England, and Strathpeffer, in Scotland, are spas which may be used by persons wishing for treatment in Great Britain. Sea air does not suit all cases, but there are some inland localities in Great Britain at moderate elevations above sea-level, such as the neighbourhood of Hindhead, in Surrey, and Braemar, in Scotland, which are good summer resorts when baths and mineral waters are not required.

In conditions of malarial and tropical anæmia without special complications in the abdominal viscera the high altitude resorts of St. Moritz and Ceresole Reale, with their chalybeate waters,

¹ On this subject see Dr. M. D. O'Connell's paper on 'Environment as a Cause of Ague,' in the *Lancet*, London, September 6, 1902, p. 662. For high altitude resorts for malarial cases see Chapter XXVIII, on 'after-cure' to spa-treatment.

can be recommended for summer. Simple thermal spas in mountain valleys, such as Gastein, in the Eastern Alps (Austria, Salzburg), and Mont-Dore (the waters of which contain a little arsenic), may be recommended when there are muscular and neuralgic pains. Other spas in mountain valleys with waters containing arsenic, such as La Bourboule, Levico (or Vetricolo), Roncesgno, and Tarasp (near the last of which are the chalybeate and arsenical waters of Val Sinestra), are suitable for a stay in summer (see Chapter XXIV). In winter the warm dry climate of the Riviera or the sunny mountain slopes near the Lake of Geneva, especially Les Avants, Glion, and Caux, offer advantages in many cases.

THE CLIMACTERIC PERIOD IN WOMEN

There are climacteric periods in the life of some men, as well as of some women, which may give rise to anxiety. In persons of both sexes the period of commencing puberty is occasionally associated with functional disturbances of the nervous and circulatory systems. It is, however, the period of the menopause in women which is most apt to be associated with mental or bodily disorders, though doubtless much more is popularly attributed to 'change of life' than justly should be. Mental disturbances at this period can often be avoided by judicious occupation of the mind, and in some cases the interest of travel or of a visit to some health resort or interesting town may serve this purpose. When there is a tendency to digestive disturbance and to disorders of metabolism (goutiness, obesity) and of the circulatory system, especially when at the same time a tendency shows itself to paroxysmal neuroses, such as migraine and asthma, attention must be paid to diet, fresh air and muscular exercise, whilst a course of spa treatment may sometimes be useful. In most cases the diet must be unstimulating, easily digested, and not too nitrogenous, especially when the menopause arrives suddenly and prematurely in women with a tendency to plethora and corpulence. When there is a tendency to plethora, obesity, and fatty infiltration of the heart, a course of treatment at some spa with sulphated alkaline waters, such as Franzensbad and Marienbad, in Bohemia, Tarasp, in the Lower Engadine, and Elster, in Saxony, may be useful. In weaker patients spas with muriated or simple thermal waters may be selected, either for a course of baths, or for the internal use of the waters, or for both combined. Winter resorts should be selected in this class of cases according to the reactive powers of the individual.

OLD AGE AND PREMATURE SENILITY

Old age has by some¹ been classed as a disease, and this classification is convenient from a climatotherapeutic point of view. Treatment is partly protective (*Schonungstherapie*) and partly what may be called 'gymnastic,' consisting in methodical endeavours to delay functional and structural decay as long as possible—that is to say, to prevent 'rusting'—by specially adapted exercises.

In old age the functional activity of the different organs of the body becomes lowered, though the deterioration often shows itself more in one system than another. Circulatory and digestive disorders, pulmonary emphysema, anæmia, and an atrophic condition of the skin, with pruritus ('senile prurigo'), may all be manifestations of senility. The ordinary quantity of food and stimulants can often no longer be taken without risk of disturbance; bodily or mental work, which formerly stimulated the energies, produces fatigue; and cold weather, which formerly raised the appetite and the desire for exercise, is in old age apt to give rise to catarrhs, attacks of bronchitis, various forms of gout and rheumatism, and neuralgia or muscular pains. Diet and exercise have to be regulated in accordance with the weaker powers of the digestive,² muscular, and circulatory systems; and, owing to the diminished power of heat-production and increased tendency to bronchitis, great cold should be avoided. Sunny and warm climates during winter, autumn, and spring are therefore often needed. Amongst such may be mentioned Cannes, Nice, Mentone, San Remo, and other Riviera resorts; Algiers, Palermo, Acireale, and some other places in Sicily; Naples, Sorrento, Amalfi, and Castellammare-di-Stabia (especially in autumn), in Southern Italy; Locarno, Pallanza, &c., on the Italian lakes; the neighbourhood of Montreux, on the Lake of Geneva; Meran, in South Tirol.

To ward off decay as long as possible, the functions of the different systems have to be kept gently exercised. During summer the simple thermal spas, especially those situated at fairly high elevations, are serviceable by promoting the circulation in the skin and counteracting a tendency to senile pruritus, and (especially when combined with Swedish gymnastics, gentle climbing exercises, respiratory exercises, or massage) by maintaining the functions of the circulatory and respiratory systems

¹ 'Galenus de Sanitate Tuenda Liber Primus,' caput v. The passage 'Senectus ipsa est morbus' occurred in Terence's 'Phormio' (act iv. scene 1), before Cicero wrote his famous 'De Senectute.'

² Habitual constipation in old age, as in middle life, can often be successfully opposed by suitable diet, exercise, abdominal massage, &c.

and the voluntary muscles. Amongst spas which have become celebrated as resorts of aged statesmen and princes, Ems and Gastein were repeatedly visited by the German Emperor William I., and Wildbad by Prince Gortschakoff. Amongst warm winter resorts Cannes owed the commencement of its popularity to the famous English statesman, Lord Brougham.

The functions of the mind must be attended to in old persons just as much as those of the body, and visits to health resorts owe some of their beneficial influence in the case of the aged to the stimulating effects on the mind of the change of scenery and surroundings. Sea voyages and easy travelling with agreeable companions may have the same effect, and so may a residence in towns, such as Rome, Florence, Naples, and Venice, which are rich in objects of artistic and historic interest. At suitable seasons of the year a visit to more northern towns, such as Dresden, Munich, Paris, Berlin, and London, with their famous museums and picture galleries, may be suggested as a change.

Premature senility can be treated on the same principles. It tends to manifest itself in special structures, systems, or functions of the body more than does actual old age; this tendency to early localised decay may be hereditary, and may be recognised long before there is evidence of old age in the rest of the body. In these cases preventive measures, when commenced early, may be useful; for instance, by regular exercise and attention to diet a tendency to premature decay in the circulatory system can doubtless often be more or less counteracted.

CHAPTER XXXIII

TUBERCULOSIS

PULMONARY TUBERCULOSIS

WE have already referred to this subject when discussing the effects of sanatorium treatment, ocean voyages, climates of high altitude, desert climates, &c. It is now generally admitted that the most satisfactory treatment of pulmonary tuberculosis is that by pure air, proper feeding, general hygiene, and careful attention to individual indications, such as in most cases can be best carried out under the personal supervision of the medical man in a sanatorium. According, however, to our definition of climate and climatotherapy (see Part I), the open-air treatment, as carried out at modern sanatoria for tuberculosis, might fairly be included amongst climatotherapeutic methods. Many old health resorts, moreover, still hold an important place in the treatment of this affection. Formerly phthisis and other chronic diseases of the respiratory organs were almost the sole objects of treatment by climate. Aretæus and Celsus recommended sea voyages and a residence at the seaside in phthisis; Galen recommended hilly districts combined with the use of milk; he spoke of Stabiæ (Castellammare-di-Stabia), and Cassiodorus mentioned Mons Lactis (probably Lettere), near Stabiæ, as resorts for phthisical patients. The elder Pliny thought that consumptives would be more benefited by residing in pine woods than by a sea voyage to Egypt or by the milk treatment in the hills.

Pure air is essential for the treatment of pulmonary tuberculosis, and although the general hygienic principles of sanatorium treatment are those now adopted, the most favourable climate that can be obtained under the circumstances should always be chosen for carrying out this treatment. In the preventive treatment of consumption, also, the question of climate, or, still more frequently, of climate in connection with occupation, has to be considered. Moreover, many persons, in spite of the modern tendency of medical opinion, altogether refuse to be treated in a

sanatorium; they have a horror of such institutions, regarding them as little better than prisons. Such persons, if they can afford the expense, must in most cases be treated at health resorts with as much supervision as possible from the local medical man. Health resorts are, moreover, often of great service in the treatment of various morbid conditions arising in chronic, quiescent, or obsolete cases of pulmonary tuberculosis.

In our opinion the following extract from the report of a Committee on the Influence of Climate in Pulmonary Tuberculosis¹ expresses fairly well the probable influence of the various climatic factors in the treatment of pulmonary tuberculosis (the italics are our own): 'Recalling the powerful rôle of streptococcal and other mixed infections in pulmonary tuberculosis, and their power of changing a simple tuberculosis with chronic advance into a destructive consumption, noting also the bad effects of dusty atmospheres in producing bronchial catarrh, and especially the rapid lessening of mixed infections and such catarrhs in the purer air of our climatic resorts, the importance of this factor (*abundance and bacteriological and chemical purity of the air*) does not need to be further dwelt on. We would only note here that we believe that the relapses of some cases when they return to city life are due to the reinfection of the diseased lung by pus organisms and to its irritation by dust.' After pure air we would place *sunshine and sunheat*, whose effects are both direct and indirect. Although the direct effects of sunshine are evidently beneficial,³ they have never been completely analysed, and therefore will not be dealt with here. The indirect effects of sunshine, as seen in its powerful stimulation of the patient's spirits, are of great importance. *Dryness* in most cases is a very important factor through its valuable anti-catarrhal effects, but when extreme this influence may be reversed, and there are not a few cases in which a *moderate degree of humidity* is more beneficial. Generally, low relative humidity with moderately low temperatures has a tonic effect, and is beneficial in irritated conditions of the respiratory mucous membrane, while such low humidity with very low temperatures, though stimulating, is apt to irritate mucous membranes. Low relative humidity

¹ By Drs. C. L. Minor, E. R. Baldwin, S. E. Solly, C. F. McGahan, H. Sewell, and N. Bridge, in *Medical News*, New York, November 11, 1905, p. 918.

² On the subject of the reawakening of quiescent tuberculous lesions in the lungs by counter-infections and 'microbic associations,' see J. R. Johnson, 'Phthisis and House Infection,' *British Medical Journal*, March 14, 1903; and F. Parkes Weber, 'Arrested Pulmonary Tuberculosis,' *Zeitschrift für Tuberkulose*, Leipzig, 1904, vol. v. p. 219.

³ It must not be forgotten, however, that *direct exposure* of phthisical patients to a hot sun may sometimes act injuriously in regard to pyrexia. See Ch. Sabourin, *Traitement Rationnel de la Phthisie*, Paris, 1896.

with high temperature is generally debilitating.¹ High relative humidity with moderate temperature is soothing to the irritated mucous membranes, but high humidity combined with low temperature favours catarrh. On the whole, in pulmonary tuberculosis low relative humidity with moderately low, or low, temperatures is most generally suitable, and the average tuberculous patient always makes his best gains in *cold dry weather*, where such conditions prevail. There are certain cases, however, which do better with a high relative humidity and warm temperature. *Equability*, where older people or the very feeble are concerned, can be of great value, but is not as important as used to be supposed. In the stronger patients *variations in temperature* stimulate the vital activities; hence, generally speaking, equability is not an important factor. *Wind*, when the patient is directly subjected to it,² is harmful, but when he is properly protected its purifying influence on the air, provided vegetation is sufficient to prevent dust storms, is beneficial. Most authorities are agreed that, other things being equal, some *degree of altitude*, owing to the great purity of the air and to its stimulating effect on the metabolism and appetite, &c., is most desirable. . . . Enough to say that care should be used to choose an altitude suited to the patient's degree of vitality and heart power.' The writers of the report then proceed to point out the great importance of considering in each case the mental temperament, docility, intelligence, and pecuniary resources of the patient when recommending special climatic treatment.

In regard to the view that in the treatment of pulmonary tuberculosis the choice of climate is unimportant provided that the air be pure, it must be acknowledged that even in ordinary health many persons feel better and are more vigorous in one climate than another. A climate which makes them vigorous when they are free from disease (such a preference of the organism for particular climates may to some extent change with age &c.), probably not only has a protective action by raising their resistant powers, but likewise will often best help them to regain their health when attacked by a chronic infectious disease like pulmonary tuberculosis. This is a minimum estimate, which cannot be ignored, of the therapeutic importance of selecting climates for consumptive patients, when the various circumstances of the

¹ The Egyptian and Nubian desert climates have, however, certainly proved useful in some cases. The great bacteriological purity of the air doubtless has much to do with this beneficial result; the considerable daily range in temperature and the open-air life in tents prevent any enervating effect resulting from the heat of the day.

² In regard to the possible harmful effect of strong winds, see our remarks in Part I, Chapter I.

case permit of any choice. Following are some principles, all or most of which have been previously expressed by Sir H. Weber,¹ for the selection of climates in cases of pulmonary tuberculosis.

In every case the constitution (that is to say, the general strength and the reactive peculiarities) of the individual must be considered. The family history often helps us to decide whether the patient is of an originally strong or an originally weak constitution, though the effects of the disease and of temporary unfavourable circumstances may often render a decision difficult. If the patient belongs to a long-lived family he probably possesses an originally strong constitution, even if several relatives have died of tuberculosis. In short-lived families, on the other hand, even if there is no history of tuberculosis, the members may be supposed to have an originally weak constitution. In pulmonary tuberculosis, as in many other diseases, a family tendency to longevity or the reverse is of the greatest importance both in regard to prognosis and treatment. In regard to treatment, the personal history often helps us in estimating the patient's power of resistance. Those persons who have always felt better, more capable of work &c. in warm weather, but in cold weather lose their appetite, flesh, and energy for work, generally belong to the class of originally weak constitutions with less power of resistance, whereas those who have felt better in cold weather have stronger constitutions and greater power of resistance. Patients who from childhood onwards have always had high fever with every slight illness, and have recovered with difficulty and who always have moist hands, are generally to be classed amongst the weak and erethic constitutions. This conclusion is frequently confirmed by the colour of the skin, the shape of the face, the general configuration of the body, the presence of an irritable cough, the weak action of the heart, and the tendency of the pulse to be influenced by the least exertion.

If the patient has a weak constitution, cold climates have usually to be avoided, and caution must be observed in recommending high altitudes and long ocean voyages; whereas warm, sunny, and sheltered winter resorts, such as Beaulieu and Mentone, on the Riviera, Pau, and sometimes the more humid localities, such as Madeira, are frequently serviceable. When the patient has an originally strong constitution, mountain climates and long sea voyages are to be preferred. Much can often be done, however, by merely keeping such patients in the open air, by feeding them well, and enabling them to take a suitable amount of exercise.

¹ See especially his address before the International Tuberculosis Congress, held at Berlin, 1899 (*British Medical Journal*, June 3, 1899).

We shall now allude to some clinical features of the disease in connection with the indications which they afford for treatment; but, needless to say, the patient's constitution and individual resisting powers must likewise always be taken into account.

In cases of limited disease at one or both apices, without fever or with only slight fever, nearly all climates can be made use of. High altitudes and sea voyages are to be preferred if the constitution is an originally strong one. Sanatorium treatment should generally be obtained, if possible in combination with a mountain climate.

In certain cases of this class, when the patient is a male and likes life at sea, and when, though his constitution was originally fairly strong, he has become infected with tuberculosis during temporary weakness from overwork, mental worry, bad hygienic conditions, or acute diseases, long sea voyages are to be preferred to all other methods of treatment.

Cases with limited local disease must be first of all (that is, during the very acute stage) treated in their houses or the neighbourhood of their homes.

Cases with extensive disease of one lung or of both lungs, without fever or with only slight fever, are more difficult to advise. In the majority of these cases treatment at an only moderate elevation or at warm seaside localities deserves the preference. Long sea voyages in some such cases, if the patient is fond of the life at sea, do good by improving the general health.

In advanced disease with hectic fever, long journeys should be avoided, and, if possible, neighbouring health resorts, together with careful supervision, should be recommended.

When there is much laryngeal or intestinal ulceration or any chronic form of diarrhoea, no considerable journey should be undertaken. In regard to laryngeal complications, it may be mentioned that, contrary to older views, G. Derscheid¹ has apparently shown, from a statistical examination of Dr. L. Spengler's practice at Davos, that laryngeal tuberculosis in itself does not constitute a contra-indication to treatment in high altitudes. On this subject Dr. S. Edwin Solly,² of Colorado Springs, concludes 'that while tubercular laryngitis is always a grave complication, at an altitude as elsewhere, and that when advanced it is almost invariably fatal, yet in the earlier and medium cases, high altitudes with appropriate treatment afford relatively, though not actually, as good a chance for arrest or delay in laryngeal as in pulmonary tuberculosis.' Of course, the dry

¹ *Tuberculose Laryngée et Altitude*, 1897.

² *Handbook of Medical Climatology*, 1897, p. 149.

atmosphere of high altitudes and all very dry climates, even in the absence of dust, increases pharyngeal and laryngeal irritability, but in laryngeal tuberculosis the question really depends on the general condition of the patient and on other complications of the laryngeal and pulmonary disease, and on the opportunity afforded at the health resort in question for skilled local treatment of the larynx. It must be remembered that in many cases of laryngeal tuberculosis the rapid advance of the disease in the lungs and larynx has already rendered the prognosis extremely bad, and made it undesirable to move the patient far from home.

In progressive tuberculosis with scattered foci in both lungs and much fever, sheltered localities near the patient's home, or the home itself, are probably the best places.

In cases of chronic, slowly progressive phthisis, better results, on the whole, are obtained from warm winter resorts and sometimes from sea voyages.

Quiescent cases, with extensive damage or cicatrization, are generally better off at only slight elevations, such as (according to the time of the year) Meran, Gardone-Riviera, Arco, Montreux, or Badenweiler, or on the Riviera, or in Egypt. Sea voyages sometimes improve the general health.

Cases complicated with kidney disease should avoid high altitudes, and select dry warm winter resorts, like Egypt or the Riviera. For English persons who cannot leave their country one of the mild seaside winter resorts like Bournemouth may be selected.

The complication of slight glycosuria does not exclude the use of high altitudes, but the latter are injurious in cases with advanced diabetes and emaciation. High altitudes should be avoided when tuberculosis is secondary to diabetes.

Chronic cases with much catarrh require winter resorts with as little wind as possible, such as Pau and Arcachon, and in England, Bournemouth. We have already alluded to the investigations of Dr. W. Gordon on the influence of rainy winds; of course this question is especially important in regard to shelter in English districts in which the moist south-west winds make themselves peculiarly felt. In the case of young persons localities of high elevation with little wind are not contra-indicated, and are often even to be preferred. High altitudes are contra-indicated in chronic cases with much emphysema or with cardiac disease; these cases require warm winter resorts, such as Madeira, the Canary Islands, and Pau, and places with pine woods, such as Arcachon and Bournemouth. During summer sheltered localities of moderate elevation, situated in large forests or in well-wooded valleys, are useful in many chronic or quiescent

cases with bronchitic or emphysematous complications. The moderately moist and refreshingly cool forest air of such localities exercises a tonic yet soothing influence, whilst the sheltered positions and shady surroundings enable patients to spend the greater part of the day in the open air. In their paper on results obtained by sanatorium treatment F. W. Burton-Fanning and W. J. Fanning¹ confirm our views in regard to chronic cases by writing as follows: 'There is one class of consumptive, we admit, for whom a better winter climate than England, anyhow that of its east coast, can be found . . . we refer to the subjects of old-standing pulmonary tuberculosis with defective circulations and inability to stand cold, with catarrhal symptoms and, perhaps, affection of the kidneys or other internal organs.'

When asthma complicates pulmonary tuberculosis the idiosyncrasies of the patient in regard to localities must be ascertained if possible. When these are unknown no certainty in the choice of climate is possible; but in the majority of relatively young persons high elevations should be preferred, whilst in older persons moderately warm localities at only slight elevations should be selected for the colder months, such as Grasse (near Cannes), Montreux, Locarno, and Meran, or else places amidst pine woods, such as Arcachon and Bournemouth.

Elderly patients with arrested pulmonary tuberculosis² often suffer from emphysema, a tendency to bronchitis, chronic digestive troubles, defective circulation and inability to stand cold weather. Some of the equable more or less sheltered and relatively warm seaside winter resorts in the British Islands are often tried in such cases, for instance, Hastings, Ventnor, Sidmouth, Bournemouth, Torquay, Falmouth, Penzance, on the south and south-west coast of England; further north, Grange-over-Sands in Morecambe Bay; and in Ireland, Glengariff and Queenstown. But all these places have the defect of considerable rainfall and deficient amount of winter sunshine as compared to many of the winter resorts in the south of Europe, for instance, those of the western and eastern Riviéras. The Riviera resorts have of course lower winter temperatures than those of the much drier Egyptian resorts (Helouan, Assouan) and than the less dry Algiers. Even, however, the colder winter resorts of the Swiss and Italian Lakes and southern Tyrol, with mean January temperature decidedly below 40° F. (Lugano, Locarno, Gardone-Riviera, Arco, Meran, &c.), have the advantage of more winter sunshine as compared

¹ 'Results obtained at Mundesley Sanatorium in the Treatment of Pulmonary Tuberculosis,' *Lancet*, London, August 15, 1903.

² See F. P. Weber, 'Arrested Pulmonary Tuberculosis,' *Zeitschrift für Tuberkulose*, Leipzig, 1904, vol. v. p. 213.

with England. The more humid of the Mediterranean resorts, Ajaccio and Corfu, have a mean January temperature of about 50° F., while the still more humid and equable resorts of Madeira (Funchal) and the Canary Islands (Orotava, Las Palmas) have mean January temperatures of 60° F. or slightly higher. Needless to say, for the younger and more robust subjects of arrested pulmonary tuberculosis wintering at high altitude resorts, such as Davos, Arosa and St. Moritz, can often be recommended; and in this connection it may be mentioned that Les Avants (3,500 feet) has the advantage of more winter sunshine over Montreux situated on the Lake of Geneva below it. During summer Gleichenberg, La Bourboule, Obersalzbrunn, Soden (Taunus), and other mineral water health resorts belonging to the muriated-alkaline, simple alkaline and muriated groups, are often resorted to by the subjects of arrested pulmonary tuberculosis for associated dyspeptic troubles, bronchial catarrh, &c. The Pyrenean health resorts, including Eaux-Bonnes, Cauterets, Vernet-les-Bains, Luchon, &c., are frequently useful when such patients get catarrhal conditions; and so is Mont-Dore, in the Auvergne, especially when there is likewise asthma.

We shall now consider a little more closely the results which may be expected from the climates which have been most frequently employed in the treatment of pulmonary tuberculosis.

High Altitudes.—The custom of sending consumptives from the hot coast of Lima to the cool altitudes of the Andes is supposed to have existed for a very long time, but Dr. Archibald Smith,¹ who for thirty years practised medicine partly in Lima itself and partly in the silver mines of Cerro de Pasco, nearly 13,000 feet above the sea, first drew the attention of the profession to the results obtained. Lima, the capital of Peru, about 12° south of the equator, had, he said, a great mortality from phthisis, but patients if they went early enough into the neighbouring Peruvian Andes, to places such as Tarma, Jauja, or Huancayo, at an elevation of 8,000 to 10,000 feet above sea-level, mostly got better. In Europe high altitudes were not employed in the treatment of phthisis until a later period. From June 1865 to June 1866 there were, in fact, only two visitors at Davos, the earliest mountain health resort of high altitude in Europe.

The exact results of treatment by high altitudes are as

¹ See 'Practical Observations on the Diseases of Peru,' *Edinburgh Medical and Surgical Journal*, 1840, vol. liv. p. 5; 'Influences of the Climate of Peru on Pulmonary Consumption,' *British and Foreign Med. Chir. Review*, October 1856, No. 36; 'Climate of the Swiss Alps and of the Peruvian Andes Compared,' *Dublin Quarterly Journal of Medical Science*, 1866, vol. xli. p. 351.

difficult to obtain as the results of any other method of treatment. Sir H. Weber obtained evidence of the condition some years after the cessation of the treatment in 144 patients. Cure was noted in 36, and in 56 there was improvement in the local signs and in the general nutrition; in 52 cases there was either no improvement, or deterioration, or death within the first three years of the treatment. The results would doubtless, he thinks, have been much better if the patients had placed themselves under stricter medical guidance, as they were advised. In 7 cases recovery seemed nearly complete when through some mistake, mostly over-exertion, a deterioration set in, which afterwards led to the fatal termination. Dr. C. Theodore Williams and Dr. L. Spengler have published more favourable results, and Dr. Turban¹ recorded 66·1 per cent. of absolute and relative cures in his sanatorium at Davos, that is, by the combined effects of the Alpine climate and sanatorium treatment. W. Ost² has recently published collective statistics of the results obtained for the five years, from 1900 to 1904 inclusive, at eight Swiss Alpine sanatoria, the elevation of the lowest of which (Wald) was 2,980 feet above sea-level. According to his figures, of the total 7,493 patients 2,334 were in the first stage on admission, 2,714 in the second stage and 2,445 in the third stage. Of the whole number 83·6 per cent. derived benefit from the sanatorium treatment; but of those in the first stage on admission as many as 97·2 per cent. were improved. Of 7,400 of the patients about whom further information could be obtained, 47·0 per cent. were 'cured' in the sense that they could satisfactorily do their work again and earn money; these 'cured' cases included 82·9 per cent. of the first stage cases. Statistics, especially those based on data collected from different sources and from different observers, have admittedly limited value. According to the data collected by G. Schroeder,³ out of 2,271 consumptive patients treated at altitudes above 3,280 feet (953 of whom were in the first stage of the disease) the result was favourable in 83·6 per cent., whilst out of 3,455 patients treated by marine and coast climates (835 of whom were in the first stage) the result was favourable in only 72·8 per cent., but the figures given by Schroeder for inland plains and altitudes below 3,280 feet (including his own sanatorium at Schömberg) show as many as 84·7 and 87·7 per cent. of recoveries respectively. In all probability,

¹ *Beiträge zur Kenntniss der Lungen-Tuberkulose*, by Dr. K. Turban, 1899, p. 154. See also comparisons made by S. E. Solly in his paper on 'Sanatorium Treatment and its Relation to Climate,' *Philadelphia Med. Jour.* Dec. 1, 1900.

² *Zeitschrift für Tuberkulose*, Leipzig, 1906, vol. viii. p. 215.

³ The chapter on Climatotherapy in G. Schröder and F. Blumenfeld's *Handbuch der Therapie der chronischen Lungenschwindsucht*, Leipzig, 1904, pp. 389-421. We have corrected two of the percentages according to the total figures given.

however, the patients treated at low and moderate altitudes, since they were *all of them sanatorium patients*, were on the whole more under medical supervision and more generally cared for than those treated at marine localities and high altitudes.

In regard to the results of *long sea voyages* Sir H. Weber found decided improvement in 34 out of 70 phthisical patients, but no obvious change in 18, and deterioration in 18. In 10 of the 34 satisfactory cases the general condition and the nutrition were much benefited, though no obvious change was observed in the local signs; in the other 24 cases improvement was noted in both local and general signs. Of the 18 patients whose condition was not much changed by the treatment, 2, it should be mentioned, lost their fever during the voyage. In 7 cases hæmoptysis occurred once or several times during the voyage, generally in the hot regions; in 1 case improvement was not impeded by the hæmorrhage. Of the 34 patients who improved, 27 were in the first stage of pulmonary tuberculosis, 6 were in the second stage, and 1 was in the third stage. 12 of the 70 patients were women, and 11 of these afterwards expressed themselves against the advisability of sea voyages for female patients.

Walshe had a high opinion of the value of sea voyages. In suitable cases, especially in young men, he thought a voyage could be of more use than any other method of treatment. Maclaren and Faber saw good results in some cases. C. T. Williams (1887) found improvement in 89 per cent. of a small number of patients.

In a series of 11 phthisical men between the ages of 19 and 35 without fever, who undertook voyages of 3 to 5 months, connected with the whale fisheries in the Northern Seas, the result, Sir H. Weber found, was very favourable in 6 cases and tolerably satisfactory in 3; the other 2 patients, it may be noted, had a special aversion to the monotonous badly prepared food which was provided.

Sir H. Weber's experience of patients in the first or second stage of pulmonary tuberculosis, who spent a longer or shorter time in yachting, has been on the whole satisfactory, but the results showed that medical supervision was required. In this respect large passenger ships with a ship's doctor have the advantage, although it cannot be said that even then the medical supervision is generally a sufficient one. Large ships specially constructed and furnished to serve as 'ocean sanatoria' for pulmonary tuberculosis would probably enable consumptives to derive the maximum benefit from ocean climates (see Chapter III).

The *desert climate* of Egypt has undoubtedly a beneficial action in many cases of phthisis. The wandering tribes of the desert, as long as they live in tents, remain free from consumption, but those members of a tribe who, for some reason, come to inhabit towns, not rarely fall victims to the disease. Amongst phthisical patients for whom the desert climate of Egypt is especially indicated, are cases complicated by emphysema and bronchitis with much expectoration, and cases complicated by albuminuria. Insomnia and nervous irritability, which may be very troublesome complications of tuberculosis, are often relieved by desert climates.

Several *mineral water health resorts* have obtained considerable popularity in the treatment of phthisical cases, and in quiescent and very chronic cases they can certainly sometimes be of use. The sulphur waters of the Pyrenees have an old-established reputation, and amongst these Eaux-Bonnes, Caunterets, Vernet-les-Bains, Amélie-les-Bains, and Luchon may specially be mentioned. At these places the catarrhal conditions associated with quiescent phthisis are often alleviated. Gleichenberg, La Bourboule, Obersalzbrunn, Soden (Taunus), and other muriated-alkaline, simple alkaline, and muriated waters are often useful for dyspeptic troubles, bronchial catarrh, &c., occurring in cases of quiescent and obsolete tuberculosis. Weissenburg, in the Swiss Canton of Berne, has a sheltered position in the beautiful pine and beech forest of a mountain valley, and is a popular summer resort for chronic cases of phthisis with catarrhal complications. Lippspringe, in Westphalia, probably owes some of its reputation to the effect of its rather moist and mild summer climate in a similar class of cases. The chalybeate spa of Reinerz, in Prussian Silesia, has a fresh moderately moist summer climate, and is likewise much resorted to by phthisical patients without fever. The reputation of all these health resorts doubtless largely depends on the presence of medical men who are thoroughly familiar with the general management of phthisical patients and with the various forms and complications of the disease. Some French physicians who think that lime salts are useful in cases of tuberculosis,¹ recommend alkaline earthy waters on account of the bicarbonate of calcium they contain.

At many sanatoria and health resorts hydrotherapeutic methods have been held in high esteem. Some indeed have advocated the use of hydrotherapeutics as the chief element in the treatment of pulmonary tuberculosis. Without going to any extreme, however, it may be

¹ See Paul Ferrier, 'La Guérison de la Tuberculose basée sur l'étude des cas de Guérison Spontanée,' Paris, 1906.

admitted that the judicious use of cold and tepid douches, shower baths, and other hydrotherapeutic measures can be of great service in the management of phthisical patients, by keeping their skin in good condition, by aiding the open-air treatment in increasing appetite and promoting general nutrition (thus enabling the organism to react better against the parasitic invasion), and by rendering the patient less susceptible to sudden atmospheric changes. It is scarcely necessary to add that, owing to their 'hardening' influence, simple forms of hydrotherapeutics must be admitted, together with climate and general hygiene, amongst our means of preventing the development of tuberculosis in susceptible subjects (preventive treatment).

Hydrotherapeutic measures were employed by Brehmer when he introduced the sanatorium method of treatment for pulmonary tuberculosis at Goerbersdorf. He made use chiefly of cold douches, which, like the so-called 'respiratory gymnastics' of various kinds, encourage deep inspirations. (Respiratory exercises in phthisical patients, however, beneficial though they are, require great caution, whatever method be employed.) Often comparatively mild hydrotherapeutic applications are to be preferred, and serve equally well for keeping the skin in good condition. The care of the skin, says Hess ('Practitioner,' November 1897), is of great importance, especially in anæmic patients and those who perspire much. At Falkenstein, in addition to regular lukewarm baths for cleansing purposes—taken by the strong in the bath-rooms, and by those who are gravely ill or feverish in a transportable bath at the bedside—the bath-room attendants rub the patients down in bed every morning: the weaker, and those who perspire much at night, with a dry flesh towel; the stronger, with spirit and water, or water only. Strong, well-nourished, and not anæmic patients, with slight apparent lung trouble, take a short sharp douche of ten to thirty seconds' duration, followed by a thorough good rubbing down and a short walk. Dr. O. Walther makes great use of the tonic effect of shower baths; in his sanatorium of Nordrach-Colonie every patient's room is provided with a shower bath. Winternitz ('Zur Pathologie und Hydrotherapie der Lungenphthise,' 1887) sponges his feverish patients in the following order: hands, forearms, arms, face, neck, axillary cavity, back, abdomen, and lastly lower extremities. To prevent the progress of bronchial catarrh in phthisical patients C. Schütze¹ and C. Clar² recommend the 'Kreuzbinde' of Winternitz³—that is, a crossed thoracic compress wrung out from cold water. The ordinary Priessnitz bandage has likewise been recommended for the upper part of the thorax in pulmonary tuberculosis. In order to produce a condition of artificial hyperæmia in the affected pulmonary apices, reclining at full length, with the pelvis and lower limbs raised, has been recommended, but for the same purpose likewise

¹ 'Die Hydrotherapie der Lungenschwindsucht.' *Arch. der Balneotherapie und Hydrotherapie.* Halle-a.-S. 1898, p. 23.

² *Blätter für klinische Hydrotherapie.* Vienna, 1892.

³ 'Hydrotherapeutics' in Von Ziemssen's *Handbook of General Therapeutics.* English translation, vol. v. 1886, p. 525. See also W. Winternitz on 'Lungentuberkulose und Hydrotherapie,' in *Wiener Medicinische Presse*, 1902, No. 3.

a thermal plan of treatment has been advocated by E. Jacoby,¹ of Bayreuth, consisting in the application for a quarter to half an hour twice a day of a kind of local hot water bath to the upper part of the thorax. These methods remind us of the principles of A. Bier's 'Stauungstherapie' (Stauungshyperæmie) and of the explanation of the action of modern methods of treating tuberculous affections given by Sir A. E. Wright in a recent paper regarding the use of ascertaining the opsonic index.²

Whatever climate and health resort be chosen for the treatment of the case, the dwelling should be carefully examined. It should get much sun, should be sheltered from winds, and be situated in a locality which is free from dust, though the ground should be dry. The house should be removed from stagnant water and swamps, and from the impure air of factories and overpopulated districts.

The cure of tuberculosis (during the early stages at least), like its prevention, is possible in all healthy climates where good diet can be obtained and where plenty of time can be spent in the open air. Some climates, however, it should be acknowledged, have advantages for various cases over other climates; amongst these those of high altitudes are especially to be noted. Climatic treatment should, however, always be accompanied by general hygienic methods.³ The patient's blind reliance on the climate and the

¹ 'Thermo-Therapie der Lungentuberculose,' *Verhandlungen des XIV. Congresses für innere Medicin*, Wiesbaden, 1896, p. 576. See also 'Autotransfusion und Prophylaxe bei Lungentuberculose,' by Dr. Eugen Jacoby, in *Münchener med. Wochenschrift*, 1899, Nos. 19, 20; also Dr. Maxim Wassermann, 'Die Verwendung passiver Hyperämie der Lunge bei Lungenschwindsucht,' *Zeitschrift für diät. und phys. Therapie*, Leipzig, 1905, vol. 8, p. 595. See also concerning the 'postural treatment' of pulmonary tuberculosis, Schenk, *Wiener med. Wochenschrift*, July 6 and 13, 1901, and Schian, *Deutsche Militärärzte. Zeit.* Feb. 1899. Wassermann (77 *Versammlung deutscher Naturforscher und Aerzte*, September 1905) includes making patients inspire through a narrow tube as a method for inducing passive hyperæmia of the lungs. H. Leo ('Ueber Hyperämiebehandlung der Lungentuberculose,' *Berliner klin. Wochenschrift*, 1906, No. 27, p. 897) strongly advocates the plan of raising the legs and lower part of the body in order to produce hyperæmia in the thorax, but admits that this treatment is contraindicated when there is a tendency to hæmoptysis.

² See 'On the Principles of the Therapeutic Inoculation of Bacterial Vaccines as applied to the Treatment of Tuberculous Infection,' *Lancet*, Dec. 2, 1905, p. 1598.

³ Dr. S. E. Solly, in his paper on 'Sanatorium Treatment and its Relation to Climate' (to which our attention was drawn by Dr. S. Solis Cohen), in the *Philadelphia Medical Journal*, December 1, 1900, sums conclusions as follows: 'Sanatorium treatment is a good thing, particularly when patients are kept in the full air, but that is not quite such a good thing, or as widely applicable, as its advocates believe. It is not the quantity of the air, or the negative virtue of purity, that is alone desirable, but the quality of the air that is also of supreme importance; in other words, climate is of the greatest value, and if equally good hygienic conditions are given to the patient, that patient who is placed in the climate best suited to his needs is going to improve the quickest, and his disease is more likely to be permanently arrested. The oft-asserted belief of the advocates of home sanatoriums that a tuberculous patient is best cured in his own climate is, I believe, a fallacy. He is cured as much on the mountain top,

absence of medical supervision frequently lead to great errors, to aggravation of the disease, and to an unnecessary fatal result. For the majority of patients, therefore, whether wealthy or poor, sanatorium treatment, with its constant medical supervision, should be preferred. For poor patients, however, it is the only really satisfactory method of treatment, and the erection of sufficient sanatoria for the poorer classes must be regarded as of national importance for every country (cf. Chapter XXX, On Sanatorium Treatment).

SCROFULA AND CHRONIC TUBERCULOUS AFFECTIONS

• (OTHER THAN PULMONARY TUBERCULOSIS)

Under the term 'scrofula' we include (firstly) a number of affections (chiefly involving the lymphatic glands, the joints and the osseous system) which since Koch's discovery of the tubercle bacillus have been recognised as tuberculous in nature; in fact, we include them in tuberculous affections other than pulmonary tuberculosis; (secondly) a tendency to chronic, indolent, inflammatory enlargement of the lymphatic glands (and lymphatic tissues), which renders them a favourite nidus for the tubercle bacillus; this second use of the term scrofula is, we believe, the more correct one. There are some who believe that all these chronic enlargements of glands are tuberculous in nature, but this view has hardly as yet been justified by pathological investigation and clinical observation. It appears more likely that in the early stages at least the so-called scrofulous enlargement of glands may be caused by chronic irritation of many different kinds without the presence of the tubercle bacillus being necessary. In fact, the lymphatic tissue of 'scrofulous' individuals apparently reacts in a manner differently from that of normal persons and is more vulnerable. The scrofulous or 'strumous' habit is chiefly noticeable during the earlier periods of life, the peculiar vulnerability of the lymphatic tissues being often lost when a child grows up. In scrofulous children dental caries, a little tonsillitis, skin eruptions &c. give rise to an excessive, but sluggish, reaction in the lymphatic glands corresponding to the part of the body affected, and the swelling in the glands may not properly subside even when the original source of irritation has been removed. Though, however, scrofulous enlargement of glands may probably

the wide plain, or the seashore as those cured at home, and no more and no less. There are certain evident economic reasons why home sanatoriums should be encouraged, up to a certain point. I believe, however, where circumstances permit, it is safer to change the air and locality of the consumptive for a time, and by doing so results are brought about much more rapidly and surely than if he remains at home; yet climate without hygiene is but as "sounding brass and a tinkling cymbal."

in the first place be caused by a variety of different micro-organisms (especially the ordinary pyogenic microbes, even though suppuration is not necessary) or merely by the irritation of unorganised substances, including bacterial products, carried to the glands from the skin or mucous membrane, there can be no doubt that infection of the enlarged glands by the tubercle bacillus is soon likely to take place. Nevertheless, even after the glands have become tuberculous, the disease generally runs a course very different from that of tuberculosis of the lungs.

In the prevention of scrofula in children, suitable feeding, pure air, and good general hygienic conditions are the points to be aimed at. The milk and other food, the air, and the ground¹ (on which the child is always crawling) must be kept by the recognised methods as free as possible from tubercle bacilli. Children of a scrofulous disposition should, if possible, not be brought up in large towns, but in healthy country localities with pure air and dry soil. The education of scrofulous children should be carried out entirely in the country, or, in most cases, better still, at good seaside localities, where moreover more attention can be paid to their physical training than in large towns. High altitudes have an especially good effect on children and young persons when there is a tendency to tuberculosis of the lungs; but in most cases of tuberculosis of the lymphatic glands, joints, and bones, and in a tendency to these affections (scrofulous disposition), marine climates seem to have the advantage of all others. The choice of the sea climate must depend, of course, on the reactive powers, but in general, as Rochard has pointed out, any sea air is better than the impure atmosphere of large inland towns. Sea voyages can practically only be obtained for children of the wealthy, but coast climates give nearly always just as good results. For children, who can stand cold and whose reactive powers are good, probably no better places can be found than the bracing health resorts on the eastern English coast. For more delicate children, who stand cold badly, especially when they are natives of more southern latitudes, such as Spain, Italy, and the South of France, the warmer seaside resorts of the Riviera and other shores of the Mediterranean (including the Adriatic), and Biarritz, and Arcachon may be preferred; and for similar cases in England the warmer and more equable localities on the south-western coast, such as Ventnor in the Isle of Wight, Bournemouth, Torquay, Penzance, &c., may be recommended for the winter.

In former years Kreuznach, Ems, Soden, Reichenhall, and

¹ Volland, of Davos, has insisted that tubercle bacilli (derived from phthisical expectoration &c.) on the floors and ground on which infants are allowed to crawl may be a chief cause of tuberculous glands &c. in young children.

other localities were frequently recommended ; but we now regard spa treatment as of secondary importance. However, inland health resorts in which brine baths can be obtained, may still sometimes be recommended, especially when resort cannot easily be had to seaside localities. In some young persons with chronic enlargement of the lymphatic glands of the neck, with or without enlargement of the tonsils, the internal use of muriated waters, such as those of Kissingen, Homburg, Reichenhall, Hall (Austria), &c., gives good results ; and gaseous thermal brine baths, such as those of Nauheim, Oeynhausen, and Salins-Moutiers, are likewise serviceable on account of their general stimulating effect on the metabolism.

In lesser degrees of *adenoid vegetations of the naso-pharynx*, and in children after the adenoids have been removed by operation, sea air is generally beneficial, and a seaside locality can be chosen according to the season of the year and the reactive powers of the patient. In similar conditions in weakly children some of the inland health resorts in the Pyrenees and elsewhere, where local sprays of sulphurous mineral waters are employed, have been much recommended by physicians on the Continent.

In scrofulous children with *tuberculosis of the joints and bones* or obviously tuberculous disease of *lymph-glands*, surgical interference must not be too long delayed, but even in these cases 'open-air treatment' in climates and health resorts, such as those already referred to, can be made good use of after operative treatment, and the surgical measures themselves seem to be more successful when carried out in suitable climates. This is confirmed by the results obtained in the sanatoria for children at Margate, at Berck-sur-Mer, at the little hospital of Samaden, in the Upper Engadine, &c. We must here once more refer to the great importance of seaside sanatoria for scrofulous and weakly children of the poorer classes. More are needed in every country, and similar institutions for weakly children might be erected at many healthy inland localities.

For the richer classes there now exist schools in suitable localities where the health of children with a tendency to tuberculosis can be specially cared for on modern sanatorium and open-air principles.

It will not be out of place here to add a few words on the *part played by diet in the development and the preventive and curative treatment of scrofulous conditions and tuberculosis*.¹ By common experience

¹ Cf. F. Parkes Weber, 'The Value of Meat in the Preventive and Curative Treatment of Pulmonary Tuberculosis,' *Zeitschrift für Tuberkulose*, Leipzig, 1900, vol. i. p. 98 ; also 'Remarks on the Relations of Pulmonary Tuberculosis to other Diseases,' *Lancet*, London, April 2, 1904, p. 924.

all are agreed on the antituberculous value of a generous diet, but in regard to the importance of relative excess in the proteid, carbohydrate or fatty constituents in the diet there is still some divergence of opinion. Many physicians¹ have held that there is a certain antagonism between gout and tuberculosis, and although there are great exceptions to the rule (notably in regard to gouty persons addicted to alcohol and gouty persons who have become generally decrepit) we believe that this antagonism does to some extent exist. This resistance of gouty persons towards tuberculosis is probably partly due to the meaty foods (butcher's meat, eggs, and all animal proteid foods) which most persons with acquired goutiness have been accustomed to indulge in freely during much of their lives. The wealthy classes on the whole, are inclined to feed excessively on animal food and by this means, in some countries at least, favour the development of gouty diseases. On the other hand, their mortality from pulmonary tuberculosis is relatively slight when compared with that of the poorer classes. In the case of large cities² when the streets are classified first in regard to the wealth of the inhabitants, and, secondly, in regard to the mortality from consumption, this can be conclusively shown. Doubtless overcrowding and all kinds of bad hygiene play an immense part in determining the relatively great incidence of tuberculosis amongst the poor, but the insufficiency of meaty food is, we believe, likewise partly responsible. The poorest classes, though they often obtain abundance of carbohydrate food, can generally obtain very little of the more expensive meaty foods. Great meat eaters, if not alcoholic, rarely, even in the most unhygienic surroundings, become phthisical,³ and it may likewise be noted that in all charitable hospitals and sanatoriums for tuberculosis more animal food is provided than the patients, owing to their poverty, can generally obtain in their own homes, whereas many of them have been already accustomed at home to as much carbohydrate food as they care for. The want of resistance to disease shown by many children who have been fed with abundant carbohydrates and with too little animal proteids has been pointed out

¹ See J. E. Pollock, *The Elements of Prognosis in Consumption*, London, 1865, p. 273; also Dyce Duckworth, *A Treatise on Gout*, London, 1890; and H. Weber, 'Discussion at the British Congress on Tuberculosis,' *Brit. Med. Jour.*, August 3, 1901, p. 317.

² In regard to Paris compare Dr. E. P. Léon-Petit, *Le Phthisique et son Traitement Hygénique*, Paris, 1895; and in regard to London see Sir Hugh Beevor's oration on the Declension of Phthisis, at the Hunterian Society of London, 1899.

³ In this connection it may be noted that striped muscle (see Part III of the *Report of the Royal Commission to inquire into the Effect of Food derived from Tuberculous Animals*, London, 1895), whether as part of a living body or as butcher's meat, is not a good soil for the growth of tubercle bacilli. Moreover, persons of great muscular development, especially of the plethoric obese type who seem to be equally rich in muscle, fat and blood, relatively seldom develop tuberculosis. Neither do those whose muscular system is kept in good order by open-air exercise, though it must be admitted that there may be, as far as physical exercise is concerned, exceptions to the rule.

by various authors.¹ Charles Richet's² experimental comparison of (a) the effects of a mixed carbohydrate and meat diet with (b) the effects of an exclusive raw meat diet in dogs previously inoculated with tubercle is not without interest in this respect, but his results have not been entirely confirmed.³ On the whole, we believe that deficiency of proteids in the diet acts not rarely, especially in young persons, as a predisposing cause of the onset of pulmonary tuberculosis, and in such cases a change to a diet containing more meat may often have a most beneficial effect, especially, of course, if combined, as it always should be, with suitable general hygienic treatment. Richet and Héricourt⁴ attach the greatest importance to the meat being raw⁵ and think that it is only the muscle plasma which is active, the parts of the meat which are soluble in water containing the active substance. Hence they term their method of treatment 'zomotherapy'—that is to say, 'meat juice therapy.' Though it is admitted that myosin albumin⁶ is easily digested by most patients and can be of great value, it is scarcely likely that the value of meat in the diet of consumptives or of patients predisposed to consumption depends entirely on the meat being raw or only very slightly cooked. It must be remembered also that a certain amount of cooked meat often powerfully stimulates the appetite and the digestion, and in some persons much more so than meat juice and raw meat do. In Great Britain, however, R. W. Philip⁷ and J. J. Galbraith⁸ have strongly advocated zomotherapy, if carried out in

¹ Cf. J. Dvorak's remarks, *Bericht über den Kongress zur Bekämpfung der Tuberkulose als Volkskrankheit*, Berlin, 1899, p. 619. Similarly, V. Klimek (*Berliner klinische Wochenschrift*, April 9, 1906, p. 474) says: 'Denn so sicher es auch ist, dass die Skrophulose wenigstens als skrophulöser Habitus angeboren sein kann, ebenso zweifellos ist es, dass die Entstehung einer erworbenen Skrophulose durch reichlichen Genuss vom groben Brot, Mehlspeisen, Süssigkeiten aller Art und dazu Kartoffeln, wenn schon nicht verursacht, so doch wachgerufen wird. Der an Skrophulose Leidende geniesst daher überwiegend animalische Kost . . .'

² Académie de Médecine, Paris, November 29, 1899.

³ See C. Fränkel and Sobernheim's paper, 'Zur Frage der Zomotherapie,' *Berliner klinische Wochenschrift*, July 15, 1901; also Lawrason Brown's criticisms in the *American Journal of the Medical Sciences*, June 1903, vol. cxxv. p. 1071. Brown agrees, however, that 'much meat, with a judicious admixture of carbohydrates, fats, &c., is essential to the treatment of pulmonary tuberculosis.' R. Villanova (*La Clinica Moderna*, May 1904) did not obtain particularly satisfactory results by the French methods of zomotherapy, though in a very severe case of tuberculosis enemata of meat juice seemed to do great good.

⁴ Académie des Sciences, Paris, February 26, 1900.

⁵ In fact, Richet (Académie de Médecine, Paris, June 13, 1905) reported that he found feeding animals with cooked meat exercised an unfavourable influence on the progress of tuberculosis. But this need not necessarily hold in the case of human beings.

⁶ See Lawrason Brown, *loc. cit.*; and F. W. Forbes Ross, 'Meat Preparations: the Possibilities of Myosin Albumin,' *Lancet*, June 22, 1901, p. 1757.

⁷ R. W. Philip, 'Zomotherapy in Pulmonary Tuberculosis,' *Practitioner*, London, January 1905, p. 14.

⁸ J. J. Galbraith, 'The Dietetic Treatment of Pulmonary Tuberculosis from the Point of View of its Hematology and Histopathology,' *British Medical Journal*, March 14, 1903, p. 600; also 'Effect of Raw Meat on the Nitrogen Metabolism in Pulmonary Tuberculosis—Zomotherapy,' *Practitioner*, London, February 1905, p. 162.

conjunction with the open-air treatment. On the results obtained by zomotherapy in this way in pulmonary tuberculosis Philip writes as follows: 'The blood presents a rapid increase in hæmoglobin. This is marked even in patients doing fairly well on an ordinary cooked diet, when they are placed on a raw meat régime. Within a few days the hæmoglobin runs up 10 to 20 per cent., falling comparatively quickly if return be made to cooked meat.' In addition to this he lays stress on the development of a lymphocytosis and on his experience that hæmoptysis is not favoured by the treatment.¹

¹ It was partly owing to the apparent antagonism between tuberculosis on the one hand and gout and meat eating habits on the other hand that Dr. H. Harper started his urea (pure urea) treatment of pulmonary tuberculosis (see his papers on this subject in the *Lancet*, March 9, 1901, June 15, 1901, and December 7, 1901, and in the *British Medical Journal*, October 18, 1902), but his high estimation of the value of this treatment has not generally been confirmed. It seems to us that, if products of proteid metabolism of the uric acid series be supposed to exercise an antagonistic influence on the development of tuberculosis, it would be more rational to give patients nuclein than urea, or, better still, to feed them on a purin-rich diet, i.e. a diet containing an excess of animal food particularly rich in nuclei, such as liver, pancreas and thymus, and also an excess of purin-containing vegetable food (lentils, beans, &c.). In young tuberculous subjects with sound kidneys and cardio-vascular systems such diet surely deserves a trial just as much as a diet rich in raw meat does, in addition, of course, to ordinary hygienic and open-air treatment.

CHAPTER XXXIV

DISEASES OF THE RESPIRATORY ORGANS OTHER THAN
CONSUMPTION

Chronic Catarrh of the Pharynx, Larynx, and Nose.—In delicate persons who stand cold badly, winter residence in warmer climates often gives relief. Egypt or the Riviera may be chosen for a long visit, or, when there is much irritation with little discharge, moister climates, such as Ajaccio, Algiers, Madeira, or the relatively drier resorts of the Canary Islands. A long ocean voyage exerts a hardening influence in some of these cases, and may prevent recurrence for some time. When nasal and naso-pharyngeal catarrh are due to the presence of nasal polypi and adenoid vegetations these causes should be got rid of. After adenoid vegetations have been removed by operation a long stay at the seaside is useful in most children, especially when there is any scrofulous tendency. In chronic laryngeal, pharyngeal, and naso-pharyngeal catarrh, causes such as tobacco, alcohol, and excessive use of the voice must of course be abstained from. In the so-called ‘clergyman’s sore throat’ (in clergymen, public speakers, singers, &c.) a long period of rest is what is required, and spas and climates can be chosen according to the patient’s constitution. A long sea voyage will frequently be useful in these cases.

In many cases the patient’s general health and constitution furnish the best indications. A kind of hardening influence can often be brought about by appropriate hydrotherapeutic measures at home and at health resorts, especially when the locality selected for treatment is warm enough and sheltered enough to allow of much time being spent in the open air. Spa-treatment during summer is often useful. For the debilitated and anæmic, simple thermal spas, muriated spas, chalybeate spas, and sometimes arsenical spas may be recommended according to special indications. In stout plethoric persons, who eat and drink too freely, a course of treatment at sulphated alkaline spas often has a beneficial effect on the pharyngeal and laryngeal trouble; but permanent alteration in diet and regimen is required to maintain the improvement. Gout, obesity, dyspepsia, chronic intestinal

catarrh, and habitual constipation require special attention when they are present, and in these cases spa treatment is frequently beneficial. In some cases local treatment is important, and a health resort has to be selected where it is known that this can be obtained. At many spas apparatus for douches, sprays, or inhalations for the nasal, pharyngeal, or laryngeal mucous membranes are much employed, notably at Cauterets, Challes, Marlioz, and other sulphur spas in France, at Ems and other muriated alkaline springs, at a great number of muriated springs, and at Mont-Dore and La Bourboule, in the Auvergne. Cauterets and Mont-Dore have attained considerable reputation for clergyman's, sore throat.

Chronic Bronchitis and Pulmonary Emphysema.—These conditions are allied to each other in so far as each of them tends to produce or increase the other. Most patients of this class stand damp cold weather and winds badly, and the winter should be spent in some warm, sheltered, sunny climate. As a general rule, when there is much expectoration, the drier climates, such as those of the Riviera and Egypt, are more suitable, and in cases with little expectoration and much irritable cough moister climates (Ajaccio, Pau, Madeira, &c.) are to be preferred. Arcachon and Bournemouth have the advantage of their pines. Sea voyages in warm climates during winter are often useful, such as to the West Indies or to the Argentine States, or yachting in the Mediterranean. During summer, localities of moderate elevation, without much wind or dust, situated if possible within or in the neighbourhood of large forests (pine forests by preference), should be selected. Such localities are Badenweiler, Baden-Baden, Wildbad, Teinach, Griesbach, Rippoldsau, &c., in the Black Forest; Friedrichroda and Liebenstein, in the Thuringian Forest; Schlangenbad, in the Taunus; Alexandersbad, in the Fichtelgebirge; Alt-Aussee, Kreuth, Achensee, and Zell-am-See, in the Eastern Alps; and Brückenau, in Northern Bavaria.

Pulmonary emphysema is in some cases merely a manifestation of senility or premature senility, which may be more or less local or part of a general change; the emphysema is in these cases an atrophic condition connected with changes in the blood-vessels and with a thinning of the walls of the pulmonary alveoli. The treatment ought to be a protective one (*Schonungstherapie*), similar to that which we have already considered under the heading of 'Old Age and Premature Senility' in Chapter XXXII.

In young patients with a tendency to bronchitis a certain amount of hardening may be effected by general hygienic treatment, hydrotherapeutic methods and residence at sheltered mountain resorts of moderate or high elevation (especially those

amidst pine forests) during summer, and in some cases even by spending one or several winters at one of the winter resorts of high altitude. Ocean voyages and yachting are likewise beneficial, the voyages to be selected according to the season of the year. During the summer a residence at fairly bracing seaside resorts often has a beneficial effect on the general health.

Mineral water health resorts can be employed in many cases during summer. In gouty and plethoric persons a course of sulphated alkaline waters (Karlsbad, Marienbad, Franzensbad, Elster, Tarasp) will often do good, but any tendency to gout and obesity and excessive indulgence in food and alcoholic drinks, all of which are very common predisposing causes of chronic bronchitis, must be combated by suitable arrangement of diet, exercise, and general regimen.¹ Many sulphur spas, muriated-alkaline spas, and muriated spas have a great reputation as summer health resorts for catarrhal conditions of the respiratory organs. Amongst sulphur spas we may mention Caunterets, Eaux-Bonnes, and other Pyrenean health resorts; amongst muriated-alkaline spas, Ems and Gleichenberg; amongst simple alkaline spas, Obersalzbrunn; and amongst muriated springs of various strengths, Reichenhall, Baden-Baden, and Soden. All such spas are furnished with apparatus or with some kind of chamber ('inhalatorium') for inhaling the vapour or spray of the water, and sometimes also possess apparatus (as at Ems) for inspiration from an atmosphere of increased pressure and for expiration into an atmosphere of diminished pressure, or have specially constructed chambers (as at Reichenhall) for temporarily increasing the atmospheric pressure; such artificial alterations in the atmospheric pressure give at least temporary relief in many cases of emphysema.

At many summer health resorts for bronchitic and emphysematous patients, milk, whey, koumiss, and other milk preparations of excellent quality are largely employed.

Bronchiectasis.—In these cases warm sheltered health resorts on the Mediterranean coast &c. are beneficial during winter, whilst during the hotter months sheltered mountain localities at medium elevations, especially those amidst pine

¹ That in some cases bronchitis may be regarded as an attempt of the organism to rid itself of toxins and waste products of metabolism by way of the bronchial mucous membrane there can hardly be a doubt. The so-called 'metastasis' of symptoms in gouty individuals from the joints to the bronchi, pharynx, or intestines may also be explained on this 'excretion theory,' as Dr. Harry Campbell has pointed out in his short but able paper on 'The Treatment of Chronic Bronchitis in the Elderly and Aged,' *British Medical Journal*, October 12, 1901, p. 1063. He likewise lucidly explains the value in such cases of pure air, suitable exercise (such as not to cause dyspnoea), avoidance of alcoholic drinks, limitation of food, and treatment for the reduction of superfluous fat.

forests, at Badenweiler, St. Blasien, Rippoldsau, in the Black Forest, are to be preferred, or a sheltered locality on the English Channel, North Sea, or Baltic. Living in pure air probably helps to lessen, or prevent the occurrence of, the fetid smell often characteristic of bronchiectatic expectoration, but in such cases Arnold Chaplin's treatment by coal-tar creasote-vapour ('British Medical Journal,' June 22, 1895, p. 1371) is doubtless of great value.

Remnants of Pleurisy and Pleuritic Effusion.—Climatic resorts are useful in many cases. The general health may remain unsatisfactory and the physical signs may more or less persist after acute or sub-acute pleurisy, especially when tuberculous or associated with pneumonia. In young persons and middle-aged persons of fairly strong constitution, resorts of high altitude are mostly to be preferred for summer, provided that there be sufficient shelter from winds and no special contra-indication. In patients of weak and nervous constitution or with injured hearts, who bear high elevations badly, sheltered localities of medium or low elevation may be selected for summer, or seaside resorts. During winter Alpine resorts are likewise often useful, but when they are contra-indicated by the constitution or the condition of the circulatory organs, the Riviera may be selected, or when there is irritable dry cough, one of the moister, more equable places, such as Pau, Ajaccio, or the Canary Islands. When the pleuritic affection is suspected to be of tuberculous nature, or when it occurs in a scrofulous subject, health resorts of high altitude should be preferred unless there be some contra-indication. In every decidedly chronic case of pleurisy the after-treatment by climate and general hygienic measures should be based on the supposition (justified by modern investigations) that the affection is probably tuberculous in origin, and especially should this be so, if the onset is insidious, and if impairment of resonance (from thickened pleura), and diminished inspiratory movement—or a certain amount of contraction of the chest wall—on the affected side are noticeable long after the attack. In this connection it may be mentioned that C. T. Williams and other observers speak of a decided increase in chest measurements as a characteristic result of residence at high altitudes, and Williams has failed to find the same thoracic development to result from residence at other resorts. Hydrotherapeutic measures, Swedish gymnastics, and the so-called pulmonary gymnastics and breathing exercises and 'artificial aërotherapeutics' may help to promote this development, if carefully adapted to individual cases.

Brine baths and hydrotherapeutic treatment may help to promote the general health, and in some of the stronger cases at a later stage the tonic effect of sea-bathing during summer may be

made use of. Slight chronic pleural effusions associated with cardiac weakness, and doubtless more or less passive in origin, may in some cases be treated by a course of effervescent baths, such as those of Nauheim, with or without the simultaneous use of the resistance exercises devised by the Brothers Schott for cardiac cases.

Hay Fever.—This affection is excited by the action of the pollen of plants (especially that arising from hay-fields) upon the nasal mucous membranes. The ordinary ‘coryza form’ and the ‘conjunctival form’ (which generally occur together), and the severer asthmatic form, are all best prevented by avoiding the exciting cause, that is, by avoiding the proximity of hay-fields. The hay fever season is naturally later in the north and colder parts of Europe than in the warm south, and sufferers, who have the means, may utilise this fact in order to escape their trouble. During the worst season a sea voyage (which gives immediate relief) is often recommended, but the patient must not return until the season for hay fever is past, for otherwise he may be again affected. Localities (such as portions of some marine spas) which are removed from hay-fields will often be sufficient to keep the patient free, and residence in a large town with paved streets often mitigates the suffering. Health resorts in the mountains and at the seaside seem likewise to act in many cases by improving the general health of the patient and rendering his mucous membranes less susceptible to the exciting cause; at all events, they frequently give relief. This relief may be compared to that obtained in many cases of ‘pure’ asthma by a visit to high altitude health resorts.

Asthma.—Asthma may be regarded as a neurosis of the respiratory functions, often induced by certain predisposing and exciting causes, which should be investigated before advice is given. Amongst predisposing causes are neurotic inheritance and acquired nervous debility (neurasthenia); constitutional conditions connected with gout, habitual over-indulgence in food and drinks, and renal and hepatic inadequacy; degenerative changes in the circulatory system, &c. Reflex exciting causes¹ must also be sought for, such as special irritability in the nose, pharynx, and respiratory passages; and abdominal causes, including dyspepsia, heavy meals and meals taken late at night, and disorders of the pelvic viscera. In cases of pure asthma (‘neurotic asthma,’ a paroxysmal neurosis) climate can often give relief, but the doctor can never say before a trial has been made which climate will suit the patient. On the whole, however, in young persons health resorts at high elevations, when there is no special

¹ See W. Brügelmann, *Das Asthma*, fourth edition, 1901.

contra-indication, give the best chances, that is to say, a greater proportion of patients get more relief from high altitudes than from other climates ; more or less complete cure is not rare. Sir H. Weber finds that the younger the individual is, the more likely is he to obtain benefit from long residence in elevated sunny regions, especially in winter. Resorts with little wind, such as Davos and Arosa, are to be preferred. Excellent localities of somewhat lower altitude are Les Avants and (during summer) the Flimser Waldhäuser, in Switzerland.

Amongst mineral water health resorts, which are visited by asthmatics, those in mountainous regions, such as Mont-Dore, La Bourboule, and the Pyrenean resorts, have the best reputation.

When the asthma is combined with decided emphysema, very high elevations cannot be recommended, but sheltered resorts in sunny positions, at moderate elevations, such as Grasse¹ (October to May), near Cannes, and even the higher localities of Glion and Les Avants, above Montreux, can be tried.

In old persons with asthma, great care must be exercised in recommending high altitudes, as arterial changes are frequently present ; this precaution is especially necessary when asthma or asthma-like attacks ('cardio-vascular asthma') commence late in life, for the respiratory symptoms are in these cases often actually caused by the cardio-vascular changes.

When asthma is connected with chronic bronchitis, the climatic treatment ought to be more that for bronchitis and emphysema than for the neurotic element. In fairly strong persons, however, without marked dilatation of the heart, a visit to Mont-Dore is often beneficial. In weaker persons, especially when there is some dilatation of the heart or decided emphysema, resorts at lower elevations are to be preferred, such as (during winter) Pau in the south-west of France, and some places of the Eastern Riviera, including Rapallo and Nervi. Amongst mineral water health resorts the muriated alkaline spas (Ems, Royat, Gleichenberg) and sulphur spas are sometimes useful, or, when cardiac weakness is a prominent symptom, the effervescent baths of Nauheim. In gouty, plethoric, and obese patients of strong constitution, a course of sulphated alkaline or simple alkaline waters may often indirectly benefit the asthmatic condition. Sir H. Weber has seen improvement in several cases from treatment at Weisenburg, which is situated in a beautiful sheltered and well-wooded valley in Switzerland, at a moderate elevation above sea-level. In cases of pulmonary tuberculosis associated with asthma, the asthma has to be taken into consideration when selecting a health resort.

¹ Grasse has indeed one of the best winter climates for the majority of cases of asthma connected with a tendency to bronchitis.

CHAPTER XXXV

DISEASES OF THE CIRCULATORY SYSTEM

WE need hardly discuss the numerous cases in which some pathological change in the valves (generally the mitral valve) is evidenced by the physical signs, but in which the mechanical fault is slight, and in which compensation is perfect with slight or scarcely appreciable cardiac hypertrophy, that is to say, cases probably resulting from an attack of acute rheumatism in childhood, and not due to, or associated with, progressive degenerative changes in the valves or walls of the heart or in the blood-vessels. In most of these cases treatment at climatic or mineral water health resorts, when indicated on other grounds, need not be much modified because a valvular murmur is present. Needless to say, however, before coming to a decision in apparent cases of this class, it must always be ascertained as far as possible by the patient's history, general condition, state of his arteries &c. whether the cardiac change is the remnant of an old rheumatic affection, or due to some slight and very chronic atheromatous change and known to have existed unaltered for years, or whether it is new and may indicate the commencement of grave progressive disease.

With the so-called functional and hæmic murmurs of the heart we are only concerned in so far as climates and health resorts may be indicated for anæmia, nervous exhaustion, and other conditions with which they may be associated. The so-called 'cardio-pulmonary' murmurs may of course occur in perfectly healthy persons, and do not require our attention.

The Heart after Acute Rheumatism.—Rest in bed not only during the acute symptoms (whether pain and fever are removed by salicylates or not), but also for a considerable time afterwards, is acknowledged to be the best preventive treatment of rheumatic cardiac disease. By careful attention to this point, as well as to diet and the customary pharmaceutical treatment, temporary endocarditis will often disappear, and doubtless endocarditis as well as pericarditis and myocarditis will often be altogether avoided. This precaution in regard to rest, simple though it appears, is by no means always easy to carry out, for patients

and their relatives, especially when salicylates are employed, soon think that recovery is complete or that for convalescence an ordinary holiday in the country is all that is required. The cardiac valves, however, though giving rise to no murmur, may be infiltrated, and muscular exercise by throwing a strain on these weakened valves may cause them to yield or to undergo chronic sclerotic and deforming changes, as Sir R. Douglas Powell has so clearly pointed out. This accounts for the fact that young patients after acute rheumatism not rarely leave the hospital with their hearts apparently unaffected, though when seen again after an interval of months or years are found to have considerable valvular defects. Premature removal to a distant health resort has to be avoided almost as much as premature resumption of ordinary work. There comes a time, however, when a change is advisable, as we have already mentioned under the heading of 'Articular Rheumatism' in Chapter XXXII, but medical supervision should be long continued in every case. In very protracted convalescence careful treatment by baths and exercises, such as those practised at Nauheim, may be useful.

The Heart after Influenza and other Infectious Diseases.—'Cardiac weakness,' with a tendency to great frequency or irregularity of pulse and irritable reaction to the slightest muscular effort or mental excitement, is not rarely one of the most prominent symptoms after influenza and other infectious diseases.¹ Sometimes also a slight dilatation may be detected. In many of these cases a change to simple thermal spas or ordinary climatic health resorts at medium altitudes may be recommended, or, during winter, warm seaside resorts, combined with open-air life and strict management of exercise. In some cases a course of Nauheim treatment may do good.

Dilatation and Hypertrophy of the Heart and Imperfect Compensation.—We have here to deal with affections of very different origins, including old rheumatic valvular affections, chronic atheromatous changes, the results of pericarditis and adherent pericardium, and the grave forms due to disease of the coronary arteries and myocardium. When compensation is satisfactory, dry inland health resorts of moderate elevation are mostly suitable; but health resorts at high altitudes are never to be recommended when the heart is much enlarged, even though compensation be perfect. In old valvular disease with early signs of failing compensation Nauheim baths and exercises are frequently serviceable, but the danger of travelling must be considered. Sir W. Broadbent and Dr. J. F. H. Broadbent in their book on 'Heart Disease' (London, 1897, p. 95)

¹ Occasionally there is temporary bradycardia.

point out that in valvular disease, when compensation has completely broken down, rest in bed and suitable treatment by other means are likely to be more efficacious than baths and exercises. In mitral disease, especially mitral stenosis, they think, when compensation is just maintained with difficulty, the Nauheim treatment may be of great service; and though in ordinary aortic disease it is not advisable, yet when mitral symptoms supervene it may become useful. Effervescent or gaseous baths can of course be obtained at very many spas besides Nauheim, including the best known chalybeate springs, but at many spas there are now arrangements by which the local baths can be artificially 'medicated' (by the addition of sodium chloride and calcium chloride or of carbonic acid gas or by altering the temperature) so as more or less perfectly to imitate Nauheim baths (see description of health resorts in Part II). Here we may mention that gas baths, that is baths of carbonic acid gas (without water) such as have been employed at various Continental health resorts, including Franzensbad, have in writing or conversation frequently been confused with gaseous baths, that is to say, baths of waters rich in free carbonic acid gas.

Angina Pectoris and Myocardial Degeneration.—When great obstruction in the coronary arteries or serious myocardial degeneration is indicated by severe attacks of angina pectoris, paroxysmal cardiac dyspnoea, permanent bradycardia, extreme irregularity of pulse, and other symptoms belonging to the grave clinical group of so-called 'myocarditis,' health resorts cannot be recommended as a rule; rest, with attention to pharmaceutical remedies, diet, &c., is what is required.

Fatty Infiltration of the Heart.—The treatment of this condition is more or less that of general obesity, to which we have already alluded. In fat and plethoric persons cardiac symptoms, such as breathlessness on slight exertion and irregularity of pulse, are very frequent, and if the abnormal fatness is allowed to progress, grave signs of cardiac incompetence, such as dropsy, &c., sometimes supervene. In regard to treatment by health resorts and otherwise it must be borne in mind that the cardiac symptoms may not be merely due to hampering of the cardiac muscle by the accumulation of fat, but also to actual disease of the muscle cells of the heart; great care must be taken to get rid of any possible causes, other than obesity, of the cardiac symptoms, such as the abuse of alcohol and tobacco. It is probably in those cardiac patients in whom the heart's action is merely impaired by the accumulation of fat and in those persons who have neglected suitable exercise, that climbing exercise, as recommended by Stokes and Oertel, may yield its best results. There are many

health resorts in broad valleys at slight and moderate elevations (Meran, Baden-Baden &c. are such 'Terrain-Curorte') admirably adapted for graduated climbing exercises of this nature. In all cases medical guidance should be insisted on, as well as attention to diet, both in regard to quantity and quality.

Senile Changes in the Heart.—Cardiac murmurs, especially mitral and aortic systolic murmurs, are often heard in the case of old persons. These often occur without there being hypertrophy or signs of obvious cardiac disease. They are doubtless due to slight sclerotic and atheromatous changes in the valves, and in such cases the remarks which we have already made under the heading of 'Old Age' in Chapter XXXII are applicable. S. Solis Cohen points out that the same advice applies to the milder forms of 'myocardial' disorders in the aged and prematurely old.

Palpitation and other Functional Disorders of the Heart.—In these cases there are generally no special indications for climates and health resorts. Attention should be paid to the predisposing and exciting causes, which include, besides the temporary debility after infectious diseases to which we have already referred, very rapid growth at puberty, overwork, impure atmosphere of the work-room, anæmia, bad habits, errors in diet, 'bolting' the food, and various digestive disturbances, tobacco smoking, &c. When the disturbance is caused or kept up by the worries and excitement of social life, a change to a suitable health resort will frequently do good. In the selection of a health resort high altitudes should be avoided in excitable individuals of weak constitution. In neurasthenic and hysterical and similar cases simple thermal spas, such as Schlangenbad, have given good results. When there is congestion of the pelvic and other abdominal organs, treatment at mineral water health resorts may often be recommended, according to individual indication. In cases associated with dyspepsia and constipation, treatment of these conditions (to which we refer in Chapter XXXVI) may suffice to remove the cardiac symptoms. We have already alluded to the cardiac symptoms, with or without dilatation, often associated with chlorosis and other forms of anæmia. Graves's disease, with its incomplete forms and allied conditions, is for convenience classed under affections of the nervous system, which we shall consider later on (Chapter XXXIX).

Degenerative Changes in the Blood-vessels.—The subject of arterial atheroma and arterial sclerosis has necessarily been to some extent already considered, that is to say, owing to their frequent association with metabolic disorders (goutiness), degenerative changes in the heart, and chronic interstitial nephritis. We

need scarcely say that in any but the slightest forms of arterial sclerosis high altitudes are contra-indicated, and in all cases sudden ascents are to be avoided. In advanced cases climatic treatment should be 'protective' ('Schonungstherapie'), warm sheltered sunny winter resorts being selected which make little demand on the resistant powers of the patient. In early stages of arterial sclerosis, occurring in stout and plethoric persons, the sulphated alkaline and the simple alkaline waters may sometimes be useful, and in thin persons the muriated waters. In such cases the manner of living has to be permanently altered, so as to prevent, or at all events retard, the further progress of degeneration. In cases of *actual aneurysm* baths and climates cannot be expected to remedy the aneurysm itself, and the excitement and exertion of travelling may do harm.

Varicose Veins and Tendency to Phlebitis.—In regard to ordinary varicose veins of the lower extremities, although venous pressure and inflammatory conditions are probably the usual exciting causes, a peculiar, sometimes hereditary, tendency towards varicose veins must be admitted in many cases. In extreme examples, indeed, varicose veins may be congenital, or almost congenital, and definitely associated with *nævus*-formation in the affected extremity.¹ In varicose veins associated with habitual constipation and hæmorrhoids the treatment for the latter complaints may be useful (see Chapter XXXVI), but mechanical appliances are seldom rendered unnecessary by the use of baths and waters. In rheumatic and gouty subjects, when there has been actual phlebitis, gaseous muriated waters, as well internally as in the form of baths, are occasionally beneficial. In all cases, whilst the remains of phlebitis of any kind are still present, it is clear that if any thermal treatment be ventured on the greatest gentleness is required, and the danger of dislodging a clot must be always kept in mind. There was formerly an idea, which is still entertained by some, that warm baths, both those of ordinary water and those of water from simple thermal springs, act beneficially in cases of varicose veins of the legs, but this is not in accordance with our own experience. Hot water baths, as well as local hot mud and peat baths, may, however, remedy the neuralgia which occasionally accompanies varicose veins; and H. Thiroux² of Saint-Amand has drawn special attention to the benefit derived from the uniform gentle compression and

¹ For the view that varicose veins are venous overgrowths, allied to venous angiomas, see A. Pearce Gould's Lettsomian Lectures in *Trans. Med. Soc. London*, 1902, vol. xxv. p. 132.

² *Troubles Chroniques de la Circulation Veineuse des Membres inférieurs, leur Traitement par les Bains Thermes*. Paris, 1896.

thermality of prolonged mud baths in the trophic disturbances ('varicose eczema,' &c.) so frequently associated with varicose veins. For the remains of phlebitis Bagnolles-de-l'Orne has a reputation in France, and the medical men of this health resort have made a special study of phlebitis and of the constitutional tendencies to phlebitis.

Plethora.—In spite of Cohnheim's classical teaching as to the great improbability or impossibility of the existence of any persistent true blood-plethora¹ the results of Haldane and Lorrain Smith's carbon monoxide method² of estimating the total quantity of the blood seem to show that in certain cases a condition of true chronic plethora or 'polyhæmia' (that is to say, an actual excess in the total volume of the blood) may exist in addition to an excess of red cells and hæmoglobin in each given volume of the blood. Conditions of this kind are doubtless mostly dependent on chronic cardiac and pulmonary disease,³ but somewhat similar conditions are probably likewise caused by excessive food-intake and deficient open-air exercise. In regard to the use of mineral waters and health resorts in such cases we must refer to our remarks under the heading of Obesity, in Chapter XXXII, and Hæmorrhoids &c., in Chapter XXXVI.

'Bad Circulation in the Extremities.'—There are many children and young adults, especially young women, who generally suffer from cold hands and feet with a tendency to chilblains in cold weather, chiefly in damp winter weather and when they are allowed to loiter about or sit in cold rooms. Sometimes the hands are swollen and bright red or livid (bluish-red) in colour, and the nose, cheeks and ears may be similarly affected, so that the condition becomes a kind of 'acrocyanosis' induced by cold. Warm clothing, nutritious diet, avoidance of sedentary habits, constipation, and excess of tea and coffee, are important, whilst a warm dry winter climate, if obtainable, will doubtless prove a successful preventive. It seems probable that a special liability to chilblains is in some cases associated with deficient coagulability of the blood and to be remedied by the administration of calcium chloride or calcium lactate.⁴ In such cases our remarks under the heading of Urticaria in Chapter XL would apply.

¹ Vide J. Cohnheim's *Lectures on General Pathology*, New Sydenham Society's translation, London, 1889, vol. i. p. 424.

² Vide J. S. Haldane and J. Lorrain Smith, 'The Mass and Oxygen Capacity of the Blood in Man,' *Journal of Physiology*, August 29, 1900, vol. xxv. p. 331.

³ We need not in this place consider such rare conditions of plethora as that described by F. P. Weber in 'A Case of Splenomegalic or Myelopathic Polycythæmia with True Plethora,' *Transactions of the Royal Medical and Chirurgical Society of London*, 1905, vol. lxxxviii. p. 191.

⁴ Vide G. A. Stephens, *Brit. Med. Journal*, April 7, 1906, p. 797.

CHAPTER XXXVI

DISEASES AND DISORDERS OF THE DIGESTIVE APPARATUS

IN most cases of organic disorders of the digestive organs climate can only take a minor part in the management, although in some cases the removal to a more tonic climate, especially the removal from a low to a high elevation, immediately removes the symptoms of dyspepsia (see later). The main treatment has generally to be by exercise, massage, diet, pharmaceutical preparations, hydrotherapeutics, and mineral waters. Climate may, however, accompany the treatment or follow it, and is often useful in very chronic cases and where there is much depression. In some of the worst of these cases sanatorium treatment (see Chapter XXX) may be advisable to commence with. In this way the patient's peculiarities in digestion and metabolism can be more readily studied (by the help of test meals and test diets &c.), the effects of different therapeutic methods can be watched, and all treatment (especially dietetic) can be more readily and surely carried out. Such sanatoria may advantageously be situated at mineral water and climatic health resorts, for mineral waters and pure air can be made to constitute an important part of the methods employed.

Dyspepsia and Chronic Gastro-Intestinal Disorders.—

In the selection of a health resort for chronic digestive disorders the quantity, quality, and preparation of the food must naturally be considered; but we have already alluded to this subject in considering the question of diet at health resorts (see Chapter XVI). The nature of the drinking water is likewise of importance, since hard water favours constipation and biliousness in some persons. It has been suggested that hard drinking water accounts for some of the constipation and biliousness in visitors to health resorts on or at the foot of the chalk downs of the south coast of England. Exercise must be regulated according to the strength of the individual, and may in many cases by itself effect the cure. Exercise, freedom from worry, and change of surroundings account for much of the benefit derived in digestive

disorders at health resorts, and for the fact that mere travelling or a holiday in the country are often sufficient to give relief. Dyspepsia is often cured more easily and more satisfactorily by other means than by mere attention to diet and the employment of drugs. This is frequently the case in overworked members of the learned professions who have been leading sedentary lives in close rooms. A holiday with change of scene and change of occupation and plenty of exercise in the open air is generally what is required, and generally speedily drives off the dyspepsia. As such persons are sure to be quite out of training, the exercise should of course not be of too violent a kind, and at the commencement of the holiday special care should be taken to avoid any over-fatigue. Doubtless the beneficial effect is partly due to the effect of the change on the nervous system, but it is probably largely also due to improved circulation in the digestive organs, including the walls of the stomach.¹ At the commencement of the holiday or the visit to a health resort a certain amount of abstinence from food is most important in many cases, especially when the stomach has been previously overworked by too frequent feeding. In these cases the overworked organs must be allowed healthful rest by long intervals between meals (unless there be some contra-indication), and by selecting the blandest diet. A great amount of self-control is often necessary at this stage, for the change of air and surroundings tends to increase the craving for food and stimulants; and the feelings of 'sinking' and 'lowness' in the gouty and dyspeptic are frequently mistaken by the patients themselves as indications for taking food, stimulants, or tonic medicine. In some such cases, however, frequent small meals of a nutritious but non-stimulating food, such as milk and its preparations, may have the desired effect, because by a milk diet the required amount of nourishment is probably obtained, though comparatively little work is thrown upon the digestive organs. By frequent meals of this kind the digestive organs may therefore be rested just as they may be by the abstinence method. The latter is generally suitable for the stronger constitutions, and the milk diet method for the weaker.

Seaside resorts and sea air are not generally to be recommended for persons with dyspepsia and chronic catarrhal conditions of the alimentary canal, when it is suspected that these are connected with a gouty tendency or with habitual over-indulgence in food and drink, or when they are associated with chronic congestion of the abdominal viscera or with diseases of the liver or kidneys. In gouty and plethoric cases dry inland health

¹ *Vide* F. Parkes Weber, 'Holidays and Spa Treatment in certain Forms of Dyspepsia,' *Treatment*, London, December 9, 1897.

resorts amongst hills or mountains at moderate or high altitudes¹ are mostly preferable; here the metabolic processes are stimulated, the feeling of energy often increased, and good opportunities for climbing exercise afforded, according to the individual powers, whilst at seaside resorts a tendency to drowsiness, indisposition for exercise, and biliousness, are sometimes occasioned.

Various complications have to be considered. Thus when there is a tendency to dilatation of the heart, with or without valvular disease, high altitudes may be unsuitable, and dry inland resorts of moderate or low elevation should be given the preference. There should be facilities for pleasant walks on level ground and at various inclinations; many of the health resorts at moderate elevations in mountainous districts where the 'Terrain-Cur' is practised are admirably adapted for this class of cases. When renal disease is a complication, dry warm climates are required, but the presence of a trace of albumen in the urine in gouty, plethoric, and other cases need not necessarily affect the choice of a locality; the condition of the heart and circulatory system and the general condition of the patient will furnish evidence in regard to the probable significance of the albuminuria.

In some persons 'dyspepsia' forms only a manifestation of a condition (hereditary or acquired) of *weak mucous membranes*, with a tendency to catarrh. Much the same management in regard to climate is required in these patients as in patients with tendency to catarrh of the respiratory organs. To some extent one may succeed in 'hardening' them by judicious hydrotherapeutic processes, and by moderately bracing sea air or by mountain resorts during summer, but they will always have to be careful in their diet, especially in regard to quantity; and in winter warm dry climates, such as the Riviera and Egypt, will often be useful. Such cases are often associated with neurasthenia, which will have to be treated by general hygienic methods &c. Mental and nervous disorders, associated with the digestive trouble, often constitute the main indications for the treatment of the latter. In many cases of long standing associated with overwork and town life, an ocean voyage with its necessary relief from business

¹ At high altitude resorts the respiratory movements are increased, firstly, owing to the rarefied atmosphere, and, secondly, owing to the fact that a certain amount of climbing exercise is usually undertaken. In artificial respiratory exercises also, with each deep inspiration the abdominal vessels can be compressed by the descent of the diaphragm and by the simultaneous contraction of the muscles of the abdominal wall. In fact, as has been pointed out by Moebius and others, a kind of gentle massage action can thus be produced in the abdomen by which blood and lymph in the abdominal viscera are propelled onwards, whilst the simultaneous expansion of the thoracic cavity tends to aspirate blood from the abdomen by the inferior vena cava and the hepatic veins. These considerations account for the good effects of high altitudes in some congested (not active inflammatory) conditions of the abdominal organs.

worries &c. is successful, while in others, especially those of an originally more robust or of a more plethoric type, change to mountainous regions with abundant open-air exercise offers the best chance.

Some chronic forms of disturbance both in the stomach and intestines occurring in oldish patients are really due to the commencement of senile changes affecting the functions of the digestive organs. They must be treated accordingly. An amount of food which formerly could easily be digested gives rise to pain or flatulence because it is too much for the weakened organs. The quantity taken must be reduced, and treatment such as that suggested under our heading 'Old Age and'Premature Old Age' in Chapter XXXII may be of use.

We now come to the employment of mineral waters in chronic disorders of the stomach and intestines. Examination (when this is permitted) of the state of the stomach in regard to its secretory and motor functions may furnish valuable hints as to the employment of mineral waters. In Chapters XIII, XVIII &c. we have referred to observations on this subject by Noorden, Dapper, Strauss, Bickel, &c. The proof afforded by the investigations of Von Mering (1893) and others that practically no water and very little salts or food can be absorbed by the walls of the stomach has some significance in regard to the internal use of mineral waters, the influence of their osmotic pressures,¹ and their effects on the secretory functions of the stomach. In conditions of deficient motor activity and dilatation of the stomach decidedly hypertonic mineral waters, such as the Hungarian bitter waters, which by their high osmotic pressure increase the fluid contents of the stomach, cannot as a rule be recommended, especially as, according to Bickel's experiments, bitter waters, though they may produce a watery flow into the stomach, depress the specific secretory activity of the gastric mucous membrane. In this connection we need not dwell on the mere antacid effects of the simple alkaline waters. Bickel, by his series of experiments referred to in Chapter XVIII, found that simple gaseous waters (such as Apollinaris and Giesshübl), muriated waters (such as the Rakoczy spring of Kissingen, and the Kochbrunnen of Wiesbaden), and muriated alkaline waters (such as Ems and Selters), all of them, as compared to distilled water and ordinary tap water, rather increased than decreased the specific secretory activity of the gastric mucous membrane, whereas simple alkaline waters (such as Vichy) and sulphated alkaline waters (such as Karlsbad) had a slight (and the purgative bitter waters a very decided)

¹ See Chapter XIV. In decided atonic conditions of the stomach the patient should, as Ageron points out (*Meuenchener Med. Woch.*, 1906, No. 40), lie down, not walk about, when, or immediately after, drinking mineral waters (cf. Chapter XVI).

tendency to diminish the gastric secretory activity. He concluded therefore that in organic gastric disorders accompanied by excessive secretion and excessive hydrochloric acidity the simple alkaline and sulphated alkaline waters are to be preferred to the muriated waters &c., whereas in conditions of subacidity and diminished secretory activity supervening on chronic catarrh and other organic diseases of the stomach, when a mineral water is required, simple gaseous waters, muriated waters, and muriated alkaline waters are to be preferred. On the other hand, in some neurasthenic cases with subjective gastric troubles and hydrochloric hyperacidity, Noorden and Dapper have shown that muriated waters, such as Homburg and Kissingen, can be of service in the treatment. In all probability in neurasthenic and functional disorders of the stomach the main treatment is the general treatment and the influence on the nervous system of the stay at a health resort, whilst the exact kind of mineral water selected is of minor importance.

As a general rule in irritation and chronic catarrhal conditions of the stomach and intestines the sulphated (Friedrichshall, Hunyadi Janos &c.) and sulphated alkaline (Karlsbad, Marienbad, Tarasp, Elster) waters are serviceable for stout and plethoric patients, especially when there has been habitual over-indulgence in food or when there is a tendency to constipation. For weaker patients of the same class muriated or muriated sulphur waters, such as Kissingen, Homburg, Harrogate, and Llandrindod, may be selected. In dyspepsia associated with chronic constipation aperient mineral waters, such as the various Hungarian bitter waters, are often useful, but the subject of constipation will be referred to further on. When there is a gouty tendency, the choice of mineral water health resorts must depend on the constitution of the patient. Needless to say that in dyspepsia from alcohol or tobacco the main indication is the removal of the cause. In many dyspeptic patients with weak mucous membranes, and in cases of 'nervous dyspepsia' in excitable persons (often due to mental fatigue and insufficient sleep), simple thermal spas at various altitudes in beautiful mountain valleys (such as Wildbad-Gastein, Wildbad in Württemberg, Schlangenbad, Plombières, Ragatz, and Buxton) may be recommended for a course of the thermal baths or suitable hydrotherapeutic methods. In anæmia and atonic dyspepsia¹ without excessive

¹ In this connection P. Bergell and A. Bickel's experiments in regard to the effect of radio-activity in mineral waters (*Zeitschrift für klinische Medizin*, Berlin, 1906, vol. lviii. p. 235) are interesting. It seems that radio-activity generally favours ferment action, and these observers found this to be actually the case in regard to the pepsin digestion of albumen. They used Wiesbaden Kochbrunnen water and found that when this water was fresh and still retained its natural radio-active properties it delayed the digestion of albumen less than it did after some weeks when it had lost

irritability or catarrh, an internal course of waters at chalybeate or muriated spas, and possibly the use of effervescent or brine baths, will often be suitable when associated with ordinary rational treatment. When there is cardiac weakness, with or without old valvular disease, a course of thermal muriated effervescent baths, such as those of Nauheim, is sometimes indicated.

Habitual Constipation.—For these cases treatment by diet, open-air exercise, abdominal massage, and pharmaceutical preparations is of great importance. However, in overworked persons of sedentary habits, change of air to some dry inland health resort of moderate or high elevation may be serviceable, associated with outdoor exercise, according to the individual strength. In stout plethoric persons an internal course of mineral waters at one of the sulphated alkaline spas (such as Marienbad, Tarasp, Franzensbad, Elster) will often do good and give relief from associated nervous disturbance and headaches. In weaker persons of spare habit of body, muriated spas (such as Kissingen, &c.) may be recommended instead.

It must not be forgotten that the frequency of action of the bowels is naturally different in some individuals from what it is in the majority. There may ordinarily be regular or irregular intervals of several days, especially in women and feeble persons who eat little. In feeble persons and those of 'nervous' constitution fatigue of mind and body often greatly favours sluggishness of intestinal action, and the tendency to constipation is sometimes further increased by extreme limitation of diet and by the excessive use of tea taken by such persons to goad on the debilitated nervous system. The general health in these cases should be improved as far as possible by appropriate means, such as moderate open-air exercise, hydrotherapeutic measures, effervescent baths, brine baths, sea-bathing, and tonic inland climates of moderate elevation. Very much interference in these cases (by strong purgatives and by attempts to increase the peristalsis by bulky meals and coarse gritty food) may sometimes do more harm than good by exhausting the sluggish bowel and setting up a catarrhal condition of the mucous membrane. In fact, it is probable that many headaches and other disorders associated with habitual constipation are really due to catarrhal conditions of the intestine¹ (rather than to the constipation itself), which favour

its radio-active properties. In regard to the influence of radio-activity on proteolytic ferments see also P. Bergell and A. Braunstein, *Medizinische Klinik*, 1905, No. 13; and P. Bergell, 'Ueber Radioaktivität,' *Verein für innere Medizin*, Berlin, July 10, 1905, and *Deutsche medicinische Wochenschrift*, August 31, 1905, p. 1894.

¹ It is probable that in the subjects of chronic constipation the relative frequency of symptoms of auto-intoxication, such as headaches, lassitude, much of the so-called

the passage into the circulation of toxic substances from the alimentary canal, which would not be absorbed were the mucous membrane free from catarrh.

Chronic Diarrhœa.—In each case the causes must be sought out, and dietetic treatment is imperative. The intestinal catarrh which leads to frequent attacks of diarrhœa with intervals of constipation is often the result of a weak mucous membrane, a condition to which we have already referred, and the treatment must be adapted accordingly. In cases of severe diarrhœa and chronic intestinal catarrh, prolonged rest in bed is most important, and treatment in these cases can sometimes best be carried out at special sanatoria. The waters and baths of Plombières have acquired a good reputation in cases of chronic diarrhœa with weak mucous membrane. In cases of chronic diarrhœa and intestinal catarrh health resorts noted for their good milk and milk preparations (see Chapter XXIX) may sometimes be given the preference.

Most cases of chronic 'morning diarrhœa' (that is, cases in which the diarrhœal or loose motions occur only during the early morning hours) yield to simple dietetic regulations, including the strict limitation of the amount of fluid which may be taken during the latter part of the day. Atony or atonic dilatation of the stomach has, doubtless, as Brunton points out, much to do with 'morning diarrhœa,' and this gastric condition, whether there is catarrh of the stomach or not, should be taken into consideration with regard to the treatment (cf. previous sections). There may, however, be other underlying causes of morning diarrhœa which require special measures.

Some cases of chronic diarrhœa and intestinal catarrh are associated with sluggishness of the portal circulation, and occasionally follow a period of over-indulgence in food and insufficient exercise, or have been preceded by constipation. These cases are often benefited, and not rarely cured, by very slight courses of aperient waters, such as Karlsbad and Kissingen.

'biliousness,' and excess of putrefactive products in the urine, has been greatly over-estimated by some authors. Hans Lorsch's ('Die Ursachen der chronischen habituellen Obstipation im Lichte systematischer Ausnutzungsversuche,' *Deut. Arch. für klin. Med.*, Leipzig, 1904, vol. lxxix. p. 383) investigations point to there being generally a diminution rather than an increase of fermentative and putrefactive processes in the intestinal contents in cases of chronic constipation. (In regard to the effects of constipation on the contents of the alimentary canal compare also Oefele's results, *Statistische Vergleichstabellen zur praktischen Koprologie*, Jena, 1904.) It is doubtless in persons who are the subjects of some form of chronic intestinal catarrh and who are accustomed to take excessive quantities of food (especially meat, which when taken in excess soon induces in some persons symptoms of auto-intoxication owing to the putrefactive changes set up) and masticate it imperfectly that constipation is most frequently accompanied by so-called 'biliousness,' headaches, &c.

Muco-membranous Colitis and Colica Mucosa. — The so-called mucous disease of the large intestine or muco-membranous colitis ('*entérite muco-membraneuse*' &c.¹ of French authors), which chiefly affects adults between the ages of 20 and 45 (mostly females), has been supposed to be a variety of chronic catarrh especially involving the glandular apparatus of the mucous membrane, and resulting from long-continued irritation by constipation in predisposed persons. It is sometimes associated with the passage of intestinal sand, the so-called '*intestinal lithiasis*.' C. von Noorden and C. Dapper,² who regard the excessive secretion of mucus as a neurosis, whether actual colitis be likewise present or not (they prefer the term '*colica mucosa*' of Nothnagel to '*colitis mucosa*'), and think that it is produced by chronic constipation in neurasthenic individuals, recommend a diet specially rich in cereals and vegetables so as to increase the bulk of the fæces and overcome the constipation. That chronic constipation plays an important part in the causation of muco-membranous colitis in many cases there can hardly be a doubt, and it is especially in such cases, and not in the diarrhoeal forms, that diet of the kind referred to is, we think, likely to be serviceable. The neurasthenia has to be treated by general methods. Noorden and Dapper likewise often give a quarter litre of a gaseous muriated water, like those of Homburg or Kissingen, in the morning before breakfast. In France the gaseous muriated waters of Châtel-Guyon³ are frequently recommended, and are likely to do good in cases associated with chronic constipation and congested conditions of the abdominal viscera. Another French resort, namely Plombières, whose simple thermal waters, unlike the waters of Châtel-Guyon, are chiefly used externally, has a well-merited reputation in muco-membranous colitis. The Plombières baths are especially indicated in cases associated with much pain. Amongst the different clinical groups⁴ cases associated with a chronic inflammatory condition (catarrhal colitis) and diarrhoeal tendency doubtless require a different diet from those associated with obstinate constipation and typical cases of

¹ F. Trémolières (*Thèse de Paris*, 1906) prefers '*entéropathie*' to '*entérite*,' '*colite*' or '*entéro-colite*' muco-membraneuse.

² Noorden and Dapper, *Ueber die Schleimkolik des Darms*, Berlin, 1903.

³ See A. Baraduc, of Châtel-Guyon, *Entérite muco-membraneuse*, Paris, 1894.

⁴ In regard to the nature and symptoms of this complaint see also the excellent account by H. Westphalen (*Berliner klin. Wochenschrift*, 1901, Nos. 14 to 16). Many French and other authors differ from Noorden and Dapper in regard to the treatment. According to P. Froussard (*Muco-membranous Colitis*, London, 1903, p. 14), 'All coarse food must be prohibited, especially that which gives too much residual matter, as green vegetables and fruits, cabbage, cauliflower, and Brussels sprouts.' Bottentuit and others at Plombières lay stress on the limitation of fluid with meals. See also A. Combe, *Traitement de l'entérite muco-membraneuse*, Paris, 1905; Bottentuit, '*Muco-membranous Colitis*,' *Brit. Med. Journ.* June 27, 1903; M. de Langenhagen, *Muco-membranous Enterocolitis*, London, 1903.

'mucous colic,' in which the bulky form of diet recommended by Noorden is most likely to be serviceable.

Hæmorrhoids, Chronic Catarrh of the Rectum, and Pruritus Ani.—A great number of these cases are more or less due to excess in eating and drinking and insufficient bodily exercise.¹ These causes will have to be permanently avoided, but a visit to some health resort is often convenient for temporary purposes, and for improving the general health. Spas with sulphated alkaline waters (Marienbad, Karlsbad, Tarasp, Franzensbad, Elster) and muriated sulphated waters (Brides-les-Bains) may be recommended in stout and plethoric subjects, and in many cases a course of treatment at sulphur waters, muriated sulphurous waters or muriated waters may do good. Inland health resorts in mountainous districts at medium and high elevations, with facilities for open-air exercise of various kinds, should be selected in preference to most other climatic stations. In autumn a 'grape cure' (Chapter XXIX) at one of the health resorts noted for their grapes may be permitted if carried out under good medical supervision, with suitable limitation of diet. We do not, of course, here refer to cases of pruritus ani due to anal fissures, polyps, &c., in which other methods of treatment are indicated.

AFFECTIONS OF THE LIVER AND BILE DUCTS

In congestion and enlargement of the liver due to alcohol, malaria, cardiac weakness, over-eating, and general obesity, treatment by alkaline, sulphated alkaline, or muriated waters is often useful, according to individual indications. Inland health resorts at moderate or low elevations, where a certain amount of open-air exercise can be obtained and much time can be spent in the open air, are mostly preferable to seaside resorts. Where cardiac weakness is in part the cause, a course of thermal muriated effervescent baths, such as those of Nauheim, may be beneficial. Alcohol must be absolutely avoided, whenever it is suspected to be more or less the cause of the hepatic enlargement (early forms of cirrhosis of the liver). In chronic catarrhal jaundice, and in convalescence from this condition, and in hepatic disorders resulting

¹ In regard to the ætiology of hæmorrhoids we may note that though passive congestion in the portal system (from any of its numerous causes) and overfeeding (and general functional over-activity of the alimentary canal), as well as local irritation (Quénu) from chronic constipation, inflammation of the mucous membrane of the rectum &c. are admittedly exciting causes of hæmorrhoids, they do not sufficiently account for their occurrence in all cases, especially in very young patients. What, however, may be termed the 'new formation' or 'angioma' theory of G. Reinbach, is sufficient to explain the peculiar disposition of some persons to develop hæmorrhoids, even when special exciting causes are apparently absent.

from malaria and long residence in tropical countries, a course of mineral water treatment at Karlsbad (sulphated alkaline waters) is a very popular treatment; a course at other sulphated alkaline waters, or at simple alkaline waters (Vichy), or at muriated sulphur waters (Harrogate, Llandrindod) is often equally beneficial.

Functional Disorders of the Liver.—A great variety of complaints are undoubtedly more or less dependent on disturbance of the hepatic functions and insufficient action of the hepatic cells, that is 'hepatic inadequacy' or 'sluggish liver,' to employ a popular term. This is not surprising when we remember the important work done by this organ, the largest of the abdominal viscera, which is still sometimes spoken of as if its only business were the production of bile. Not to mention its glycogenic and 'storehouse' functions, it takes a chief share in forming urea and the end-products of nitrogenous metabolism, and it stands in the way to prevent toxic substances manufactured in the intestines from entering unaltered into the general circulation, and thus injuring the delicate tissues of the nervous system. Indeed, some regard the bile as little more than a waste product, which the liver has to get rid of in exercising its important metabolic functions. It can hardly be doubted that amongst affections more or less connected with functional disorder of the liver, one may rightly include many cases of gastro-intestinal and 'bilious' disturbance, and many cases of 'gouty' glycosuria and of the slight albuminuria sometimes noticed during dyspepsia and temporary malaise, also many cases of troublesome pruritus, myalgia, neuralgia, headache, irritability, and insomnia, and, as Burney Yeo holds, many cases of 'irregular gout.' The treatment of these conditions, at least as far as climates and health resorts are concerned, is mostly alluded to in other sections—for instance, in those on gouty conditions and on headaches. According to the special features of each case the management must consist in regulation of diet, fresh air, avoidance of strong winds and chills, suitable muscular exercise, massage, deep respiratory movements, hydrotherapy, stimulating mineral water baths, and the internal use of mineral waters, especially those belonging to the aperient and alkaline groups. In regard to climate, cool inland summer resorts of moderate or even high elevation above sea-level, and tolerably sheltered from winds, are probably the most generally suitable. There should be pleasant hilly woodland in the neighbourhood, with shady paths on the slopes for exercise in hot sunny weather. Seaside resorts,¹ especially those actually at sea-level, should generally not be selected, and must in some cases be

¹ Compare F. P. Weber, 'On the Biliousness Sometimes Induced by Sea Air,' *Treatment*, London, January 11, 1900.

altogether avoided. Often, however, situations on slopes or plateaus near the sea, but elevated a few hundred feet above it, are better tolerated. In any case, patients of this class should be cautioned to be particularly moderate in their diet whilst staying at the seaside, and to keep their bowels open, if necessary, by the help of aperient waters, occasional mercurial purges, &c.

Cholelithiasis (Biliary Concretions).—The chief causes of cholelithiasis are (firstly) chronic inflammatory and catarrhal conditions of the biliary passages and gall bladder, which, whether due to the local presence of microbes or not, give rise to an increased formation of cholesterin; and (secondly) delayed flow of bile. In order, therefore, to get rid of the causes of the complaint, the circulation of blood in the liver may be accelerated by exercise (preferably in the open air), the flow of bile may be promoted by the ingestion of suitable quantities of liquid (for instance, a tumblerful of warm or cold water night and morning), and gastrointestinal disorders (with the resulting irritation of the liver and biliary passages) may be remedied by appropriate diet, exercise, massage (local or general), aperients, mineral waters, &c.

P. J. Mœbius, from experience in his own person, has pointed out the value of the systematic use of deep inspiratory movements in some forms of hepatic disorder. With each deep inspiration we know that the liver and other abdominal viscera can be gently squeezed by the combined contraction of the diaphragm and the abdominal walls,¹ so that the movements of the blood and lymph and the flow of bile are all accelerated, whilst the simultaneous expansion of the thorax tends to aspirate blood from the inferior vena cava and the hepatic veins, and thus also contributes in promoting the hepatic circulation. It is clear, therefore, that voluntary exercise and all methods which increase the inspiratory movements may be considered as a kind of preventive treatment of cholelithiasis. Amongst such means, residence in hilly and mountainous regions, especially at high altitudes, must be included, for not only does the rarefied atmosphere of high altitudes increase the inspiratory movements, but the climbing exercise associated with the residence in mountainous districts has a similar but still greater effect. When gall-stones have been apparently got rid of by spa-treatment, or by operation or otherwise, the principles of this preventive treatment to which we have referred may well be employed to prevent recurrence. Naturally sudden violent movements may cause biliary concretions to shift their position and thus occasionally give rise to attacks of biliary colic, but steady walking, or climbing exercise (i.e. up and

¹ At all events, when the inspiratory movement is of the thoracic type.

down hill walking), is not likely to act in this way in ordinary quite quiescent cases. In such cases exercise in the open air is doubtless generally to be preferred to mere indoor movements, but over-fatigue should be avoided.¹

For cholelithiasis various mineral water health resorts have attained a great reputation, especially Karlsbad, with its warm sulphated alkaline waters, Vichy, with its simple alkaline waters, and, to a less extent, Contrexéville, with its earthy waters (larger quantities of the latter water than of the two former are generally used). Muriated waters (Kissingen, Homburg, &c.) and muriated sulphur waters (Harrogate, Llandrindod) are likewise sometimes employed. Mineral water treatment tends to dilute the bile and to counteract the tendency to catarrh of the bile passages. By rendering the bile thinner and less sticky, as Lauder Brunton has pointed out, the shifting of biliary concretions is favoured: that this is actually the case is evidenced by the statement of J. Mayer,² of Karlsbad, that attacks of biliary colic and the passage of gall-stones are frequent at Karlsbad. Such attacks of biliary colic, when associated with the passage of gall-stones or gall-sand, may in some cases permanently get rid of the cholelithiasis, but in other cases, when the gall-stones are very numerous or of large size, this is impossible, and the concretions can then only be completely removed by operation. Even when, however, the concretions cannot be removed by mineral waters, spa-treatment may give relief by allaying the associated tendency to inflammation in the gall-bladder and bile-passages, and by improving the circulation in the liver and the general condition of the body. It is doubtless for this reason that Hans Kehr,³ of Halberstadt, recommends a course at Karlsbad after operations for gall-stones. In many cases of chronic cholelithiasis it is impossible to say whether a course of treatment at Karlsbad or other mineral water health resorts will be useful or not, and in such cases the treatment can be fairly tried before operation is resorted to. On the other hand, mineral water treatment cannot take the place of surgical treatment in most cases of chronic obstruction in the common bile-duct, in cases where the gall-

¹ Exercise has of course to be avoided whilst there are any inflammatory or other active signs. Moreover, when patients are undergoing active spa-treatment, as at Karlsbad, fatigue may doubtless be harmful, and F. Fink's suggestion to establish open-air 'Liegehallen' for cholelithiasis patients at Karlsbad has much to recommend it (see Fink, 'Liegehallen für Gallenstein Kranke,' *Münchener med. Wochenschrift*, 1906, No. 22, p. 1061).

² *Verhandlungen des XVII. Congresses f. innere Medizin*, 1899, p. 509.

³ *Münchener medizinische Wochenschrift*, September 20, 1898. On the whole subject of spa-treatment and surgical operations in cholelithiasis see also H. Kehr, *Die interne und chirurgische Behandlung der Gallensteinkrankheit*, Muenchen, 1906.

bladder can be felt full of concretions, in cases of chronic cholelithiasis, which have already resisted balneotherapeutic and other treatment, and, naturally, when acute suppurative inflammation has occurred in connection with the presence of biliary concretion.

When chronic cholelithiasis, with or without obesity, is complicated by cardiac dilatation or any form of myocardial disease, the daily amount of fluid in the diet must be limited, and all ideas of a 'washing out' treatment by drinking large quantities of mineral waters must be set aside on account of the danger of throwing extra work on an already overburdened heart.

CHAPTER XXXVII

DISEASES OF THE URINARY ORGANS

Chronic Nephritis.—When the patient is in a state fit to travel, warm climates are to be recommended during winter. On account of the dryness of the air, health resorts such as Assouan, Helouan, and Mena House in Egypt are to be preferred, but the relatively dry warm marine health resorts of the Riviera, or moister places such as Algiers, are often likewise suitable. In England, when the patient cannot leave home for the winter, one of the mild south-western seaside resorts may be selected, such as Bournemouth, Sidmouth, and sheltered parts of Torquay and Falmouth. In the selection of health resorts, and likewise of dwellings in health resorts, the necessity of shelter from winds must always be taken into consideration. During summer a course of treatment at simple thermal or weak alkaline spas is sometimes recommended, and summer health resorts noted for their excellent milk and milk preparations, such as koumiss and kephir, are often visited. The quantity of milk and mineral waters taken by patients with renal affections may, however, sometimes be excessive. In this respect Carl von Noorden¹ has clearly pointed out why particular caution should be exercised in cases of chronic interstitial nephritis, especially when there is any tendency to dilatation of the heart. We may likewise observe that the practice of selecting very dry hot climates in preference to mild climates of medium humidity (partly with a view to sparing the patient's kidneys by encouraging evaporation from the body) and the practice of increasing the amount of fluid which has to be secreted by the kidneys (as is done when courses of mineral water and fluid diet are recommended) seem to be somewhat at variance with each other.² Individualisation is doubtless required in regard to both these points of treatment.

In regard to grave cases of chronic parenchymatous nephritis in ordinary or hospital practice in which, owing to dropsy or

¹ See also 'The Treatment of Chronic Nephritis by Mineral Waters and Baths,' by Dr. J. M. Groedel, *Practitioner*, London, December 1901, p. 660; see also L. Mohr and C. Dapper, 'Ueber den Einfluss vermehrter und verminderter Flüssigkeitszufuhr auf die Function erkrankter Nieren,' *Zeitschr. f. klin. Medicin*, 1903, vol. 1.

² Noorden (*Die Behandlung der acuten Nierenentzündung*, Berlin, 1902, p. 31) points out that the practice of giving much water in acute nephritis is somewhat opposed to the most probable explanation (i.e. diminishing the work thrown on diseased organs) of the beneficial effects of removal of water through the skin by hot-air baths, &c.

threatening dropsy, a diet specially poor in common salt is being tried, it is important, when for any reason mineral waters are desired, to select only those which contain extremely little common salt, such as: the Klausensquelle of Gleichenberg, the Georg-Victorquelle of Wildungen, Giesshübl, Neuenahr, &c.¹

In the early stages of chronic interstitial nephritis in gouty subjects the climatic and balneotherapeutic treatment for the gouty condition ought to be adopted. In cases of pulmonary tuberculosis high altitudes, which one might otherwise be inclined to recommend, are excluded by the presence of renal disease; suitable health resorts and sanatoria at moderate and slight elevations have to be preferred, and the winter should if possible be passed in warm and dry climates at localities where adequate medical supervision can be obtained. In cases of chronic albuminuria complicated with anæmia chalybeate waters are not rarely useful.

In the **lesser and temporary forms of albuminuria** the cause may be functional or organic disorder of the digestive or metabolic organs rather than disease of the kidneys, and treatment by climate and mineral waters may sometimes be recommended in addition to dietetic and other means. In some of these cases mere change of climate and surroundings may suffice to remove the albuminuria, just as it may remove temporary glycosuria and act beneficially in a number of other morbid conditions. In such cases the relief from mental anxiety and overwork often probably plays a part in the results obtained from climatic treatment.

Of the various classes of *albuminuria in apparently healthy persons* that termed *postural (orthostatic)* or *cyclic albuminuria*, which was clearly differentiated in 1885 by F. W. Pavy,² comprises a distinct group of cases in which albumen is absent from the urine when the patient has been lying down, but quickly appears after the upright position is assumed, and is therefore ordinarily present in the urine passed after breakfast; the amount of albumen varies considerably at different hours of the day. This form of albuminuria has been chiefly or almost exclusively noticed in children and adolescents. Some of them appear pale and easily tired, and some also give a decided family history of pulmonary tuberculosis. In such cases, though the prognosis appears to be good, a specially hygienic mode of life, with much time to be

¹ See H. Tischler, *Therapeutische Monatshefte*, Berlin, April 1906, p. 185.

² 'On Cyclic Albuminuria,' *British Medical Journal*, October 24, 1885, p. 789. W. Moxon, however (*Guy's Hospital Reports*, 1878, vol. 23, p. 236), had certainly recognised an 'intermittent albuminuria of adolescents,' and had alluded to a 'remittent albuminuria' in which the albuminuria was specially marked after breakfast, though generally absent on rising from bed in the morning.

spent in the open air, in a healthful country district, should generally be advised. In other cases there appears to be nothing wrong with the general health, and probably no special treatment is required. In some cases a diminished coagulability of the blood accompanies the albuminuria, and it is interesting to hear that the latter can be checked by the calcium salts in a pure milk diet.¹ The calcium salts in some mineral waters (cf. p. 348) are perhaps sufficient to have a similar effect.

Paroxysmal Hæmoglobinuria, though not strictly speaking a disease of the kidneys, may be alluded to in this place for convenience. The paroxysms are certainly induced in some of these cases by fatigue and exposure to cold. Sir H. Weber knows of good results obtained from residence in warmer climates, such as the East and West Indies and Egypt; a trial of these can be recommended, especially during the colder part of the year; malarious districts having of course to be avoided. A congenital or acquired syphilitic taint, sometimes associated with this affection, need not alter the climatic indications. Incidentally it may be noted that patients liable to the grave or mild forms of *Raynaud's phenomena* (a condition sometimes associated with paroxysmal hæmoglobinuria) are generally best off in warm climates.

Urinary Gravel.—Under this heading we shall consider uric acid gravel only, and shall refer to deposits of oxalate of lime ('oxaluria') and phosphates ('phosphatic gravel') under separate headings. The precipitation of uric acid and its salts in the urine, though pathologically allied to the deposition of gouty concretions in the joints, very often occurs quite independently of the latter; sometimes patients with articular gout never suffer from gravel,² and *vice versa*. Like articular gout, however, uric acid gravel mostly occurs in persons who eat largely and take much alcoholic stimulants, or belong to gouty families. The arrangement of diet (especially by limitation of foods rich in nuclein and purins) and regimen is essential. Though sudden and excessive muscular exercise in persons who are out of training may be harmful by inducing excessive nitrogenous catabolism and increasing the amount of uric acid in the urine, a proper amount of open-air exercise promotes oxidation in the body, and must obviously be useful. Climatic health resorts should be selected much as they are in gout. The neurasthenic condition or nervous irritability

¹ See Clement Dukes, on the 'Albuminuria of Adolescents,' *British Medical Journal*, October 7, 1905, p. 848; and A. E. Wright and G. W. Ross, 'On the Discrimination of Physiological Albuminuria from that caused by Renal Disease,' *Lancet*, October 21, 1905.

² In gouty persons it appears that there is often diminished excretion of uric acid.

sometimes associated with uric acid gravel will probably be diminished by the freedom from worry at health resorts.

Mineral water health resorts are often recommended: the sulphated and sulphated alkaline springs for the stout and plethoric, especially when there is constipation; the simple alkaline springs when, owing to a tendency to diarrhœa, the aperient sulphates have to be avoided; in weaker constitutions the muriated, or simple thermal, or earthy¹ (Contrexéville and Wildungen) waters. The waters of Luhatschowitz² and Vidago are much employed as dietetic drinks, but sometimes the use of ordinary hot water or distilled water, or weakly mineralised table waters, such as Apollinaris, Johannis, Rosbach, Giesshuebler, are sufficient, especially when taken night and morning. Water drinking serves to dilute the urine by increasing the amount secreted, and the saline constituents of mineral waters when they leave the body by the urine tend to keep the uric acid in solution and prevent concretions forming in the urinary passages. (Cf. J. Felix's experiments with Châtel-Guyon water, referred to on p. 400.) Dr. S. Gee finds that a large teacupful of fresh whey taken after each meal suffices to prevent the appearance of uric acid gravel in cases that he has observed (see section on Milk Cures &c. in Chapter XXIX).

Before leaving the subject we would mention that by uric acid gravel we refer to deposits of uric acid in the urine, occurring either before the urine is passed (which is relatively rare), or soon afterwards. The copious precipitation of urates in the urine after standing and cooling, though doubtless an allied phenomenon (in regard to metabolism), is of much less importance, and hardly calls for special treatment, unless it occurs very frequently or habitually, in which case faulty habits in regard to diet, regimen &c. have to be corrected. A mere deposit of urates in very acid urine on standing does not necessarily signify that the total excretion of uric acid salts is in excess of the normal.

Oxaluria.—Oxalic acid can be produced from uric acid by oxidation, and the condition of oxaluria is frequently associated with that of uric acid gravel, so that the indications mentioned in the preceding section more or less apply here. Sometimes oxaluria seems to be connected with imperfect carbohydrate metabolism, which in a more advanced degree may lead to the

¹ Here we may allude to a possible influence of calcareous salts on the metabolism and their effect in some cases of reducing the secretion of uric acid in the urine (Kionka, Noorden, &c.). See Chapter XXVI.

² Treatment by the exported waters of Luhatschowitz often gives satisfactory results, and can be continued for a long time without rendering the urine too alkaline and without producing depression. Two or three tumblerfuls can be taken in the 24 hours, but the amount required varies in different individuals. The effect on the urine should serve as a guide.

appearance of sugar in the urine, as a form of 'alimentary glycosuria.'¹ In persistent oxaluria with dyspepsia, especially in arthritic subjects, the digestion and general metabolism, which are at fault, may often be treated by courses at mineral water health resorts together with attention to regimen and diet. The occurrence of 'alimentary oxaluria' from the oxalic acid in certain vegetables and fruits (sorrel, rhubarb, bananas, &c.) must not be overlooked. The alkaline earthy springs of Contrexéville, Vittel, Martigny-les-Bains, and Wildungen are often to be preferred, but sometimes the simple alkaline springs (Vichy &c.) and the muriated alkaline springs (Luhatschowitz &c.) may be tried, and when there is constipation the muriated springs (Kissingen, Homburg, &c.). When it is the nervous system which owing to overwork and mental anxiety is chiefly at fault, mere change by travelling or by a sea voyage may be sufficient; or a stay at some quiet health resort may be recommended, with or without balneotherapeutic or hydrotherapeutic treatment.

Phosphaturia.—By this term we mean the passage of urine which when passed is already either turbid owing to the precipitation of earthy phosphates or actually contains 'phosphatic gravel.' The term does not imply that the total excretion of phosphates in the urine is necessarily in excess of the normal. Special treatment at health resorts is rarely required in these cases. The condition often occurs in students and men of sedentary habits, especially when overworked. In these cases a holiday in the country and exercise in the open air have the most beneficial influence on the disordered nervous condition, which is sometimes the main cause of persistent phosphaturia. Exercise probably acts also by improving the circulation in the stomach, and thus facilitating the return of the hydrochloric acid of the gastric secretion into the blood, and so diminishing the alkalinity of the blood and urine. Exercise such as fencing, riding, golfing, lawn tennis, cycling, walking tours, mountain climbing may free the urine from phosphatic deposits.² Hydrotherapeutic measures, inland brine baths, and sea-bathing, recommended according to the general strength of the patient, may have a good effect by their tonic action. Sometimes an internal course of muriated waters at spas, such as Kissingen and Homburg, may act beneficially. Moderation in the amount of food is likewise important.

Calculi in the Kidneys and Bladder.—Small calculi are occasionally passed in the urine under treatment by mineral

¹ Cf. Paul Mayer (of Karlsbad), 'Ueber unvollkommene Zuckeroxydation im Organismus,' *Deutsche med. Wochenschrift*, 1901, Nos. 16 and 17.

² Compare Brunton's *Lectures on the Action of Medicines*, 1897, p. 540.

waters, such as Karlsbad, Vichy, Vals, Vidago, Contrexéville, and Wildungen. The best way, however, to prevent the necessity for surgical interference is by preventing the formation of the stones by opposing the tendency to uric acid gravel &c. according to hygienic, dietetic, climatic, and other indications (see preceding paragraphs).

Chronic Pyelitis and Chronic Catarrh of the Urinary Bladder (not due to tuberculosis or the presence of a calculus) may sometimes be benefited by climatic or mineral water health resorts when selected according to general indications. In stout and plethoric persons the use of sulphated and sulphated alkaline (Karlsbad &c.) waters may be beneficial, especially when there is constipation, and in gouty subjects (the so-called 'gouty cystitis' &c.) the alkaline (Vichy, Vals, Vidago, &c.) and muriated alkaline (Luhatschowitz, &c.) waters may be serviceable; the earthy waters of Contrexéville and Wildungen probably owe their effects to the flushing out of the urinary passages. In these cases the diet must always be attended to, the meat limited, and alcoholic stimulants and spices avoided as far as possible. Baths and hydrotherapeutic measures may be useful by promoting the activity of the skin. In regard to climates, cold and damp places and strong winds are to be avoided. During summer, dry sheltered inland localities at low or moderate elevations may be selected, and in winter a warm sunny health resort, for instance on the Mediterranean or in Egypt. In these cases milk and milk preparations are important articles of diet, and during summer one of the European localities famous for their 'milk cures' &c. (see the section on Milk Cures &c. in Chapter XXIX) may be chosen.

Chronic Urethritis and the remains of Gonorrhœa.—Like various local infective processes, gonorrhœa has a tendency to persist in a chronic form when there is an anæmic or scrofulous tendency, or when the general health is impaired in any way. A holiday and change of regimen may exercise a beneficial effect in such cases of chronic gleet. The combination of rest with tonic open-air treatment obtained by long sea voyages has an especial chance of doing good. Mineral water health resorts and hydrotherapeutic treatment can be employed according to individual indications. The health resort of Wildungen, in the Principality of Waldeck, has a great reputation in Germany in cases of chronic gonorrhœa and urethral stricture, principally owing to the skilful local treatment practised there. When the urethritis is connected with gout (so-called 'gouty urethritis') the remarks made in regard to 'gouty' cases of cystitis and in regard to gouty conditions generally (see Chapter XXXII) are to some extent applicable.

CHAPTER XXXVIII

DISORDERS OF THE SEXUAL SYSTEM

DISORDERS OF THE SEXUAL SYSTEM IN MEN

DISEASES of the generative organs in men are not very amenable to climatotherapeutic and balneotherapeutic treatment. In cases due to tuberculosis and syphilis, the treatment, as far as climate and health resorts are concerned, has already been considered.

For excessive nocturnal emissions chalybeate spas and tonic climates may occasionally be recommended to anæmic young men, but in most cases the ordinary general rules are much more important (active open-air life and healthy mental occupation, avoidance of any 'atmosphere of sexual excitement,' such as certain books, certain theatrical entertainments, &c., and avoidance of constipation, heavy bed-clothes, and late meals and drinks).

In impotence and diminished sexual power connected with disordered states of the general health, the whole condition has to be considered, and climate and health resorts may sometimes take a part in the treatment. Thus, when anæmia, glycosuria, gout, chronic dyspepsia, cardiac weakness, and neurasthenia are concerned, the remarks we have already made on the treatment of these conditions have a bearing; urethral stricture requires, of course, local treatment. The recovery from temporary impotence following acute infectious diseases may be promoted by tonic climates, especially those of high altitudes, but it may persist when convalescence in other respects appears complete. In cases due to mental overwork, worry, and shocks, long holidays in suitable climates, with abstinence from all attempts at sexual intercourse, may be followed by recovery in some cases, though in other apparently similar cases the function appears to have ceased owing to a kind of premature senility. In the overworked and mentally depressed, long sea voyages, where there are no contra-indications, offer a good chance of success.

DISORDERS OF THE SEXUAL SYSTEM IN WOMEN

In **amenorrhœa** due to anæmia climates and health resorts often, as already indicated, are useful in treating the anæmia. Warm climates tend, on the whole, to increase the menstrual functions. In middle-aged women with a tendency to obesity and rheumatic or gouty pains, sulphated alkaline or alkaline waters and moor baths, such as those of Franzensbad, may be beneficial, followed by residence in dry inland climates at medium or high elevation.

In some cases of **menorrhagia** the congestive tendency in the abdominal viscera seems to be favourably affected by residence at high altitudes.¹ This beneficial effect may be partly due to the increased respiratory movements at high altitudes which favour the circulation of blood in the abdominal and pelvic viscera, but it may also be partly due to the lower average temperature of the air which by making greater demands on the heat production and therefore on the metabolism of the body, diminishes a tendency to plethora; this is indeed a particularly likely explanation in the case of women whose food-intake is rather excessive and who ordinarily get rather too little muscular exercise. In the same connection it must not be forgotten that menstruation, other influences apart, tends to commence earlier and be more profuse in hot climates than in cold ones. In menorrhagia connected with chronic congestion and enlargement of the uterus (often due to subinvolution after childbirth or abortion) a long course of treatment at muriated, muriated alkaline, or sulphated alkaline spas, followed or interrupted by residence at a climatic health resort of medium elevation, often gives good results; in these cases, especially, is a prolonged period of rest for the organs required, the congestive tendency being certainly kept up by sexual intercourse. The mere separation from the husband during residence at a health resort may have a good effect. The menorrhagia associated with uterine fibroids is frequently favourably influenced by a course of brine baths, such as those of Kreuznach and Woodhall Spa. In middle-aged women with a tendency to plethora and obesity, treatment at sulphated alkaline spas, such as Franzensbad, with suitable regulation of the diet and regimen, may be recommended, especially where there is constipation, and should be followed by a stay at some climatic health resort of moderate or high elevation. When there is cardiac dilatation, thermal gaseous muriated baths (Nauheim), with or without resistance exercises, are often useful; high altitudes are contra-indicated. Hydrotherapeutic measures and sea-bathing are sometimes useful in

¹ See Dr. Septimus Sunderland, in *Journal of Balneology and Climatology*, London, January 1898, and *Lancet*, October 15, 1898.

patients with menorrhagia requiring tonic treatment; and chalybeate and arsenical spas can be employed in certain associations of anæmic and debilitated conditions with excessive menstruation. It is possible that some cases of menorrhagia occurring in women who are the reverse of 'full-blooded,' might be remedied by the internal use of calcium salts (compare A. E. Wright's writings, already referred to in Chapter XIV, on the calcium treatment of tendencies to hæmorrhage &c. in persons with diminished blood-coagulability). If this supposition proves correct, alkaline-earthly or alkaline-earthly-chalybeate waters might also be found beneficial in such cases.

Dysmenorrhœa connected with chronic congestive conditions of the pelvic organs and subinvolution of the uterus may be treated by simple thermal baths, hot baths of mud and peat, and other thermal baths, at various health resorts, and by internal courses of muriated, muriated alkaline, and sulphated alkaline waters, the latter especially when there is constipation. Chalybeate and arsenical spas associated with gentle hydrotherapeutic measures may be useful when there is anæmia. Warm climates sometimes diminish the pain in cases of dysmenorrhœa with scanty menstrual flow. In delicate thin patients of an irritable nervous constitution simple thermal spas during summer and warm climates during winter may be tried; but the condition in these 'neurasthenic' subjects is often very intractable, and in some cases may more or less persist through the whole period of sexual life. An open-air life, with suitable occupation and muscular exercise, but with the avoidance of physical and mental over-exertion, can do much good, and this may be rendered possible by selecting warm climates for winter residence, where much time can be spent in the open air. It is probable that care of the physical development of growing girls by encouraging open-air exercises and games (walking, cycling, riding, swimming, rowing, lawn tennis, &c.) and by preventing all over-exertion, and especially too prolonged indoor occupation, has a preventive action in regard to the neurotic forms of dysmenorrhœa.

In leucorrhœa, chronic metritis, and endometritis, and the remains of perimetritis and parametritis, baths and spa treatment are very frequently employed. Some of the remarks made in the preceding paragraphs apply likewise here. In the selection of health resorts for this class of cases the presence of any special constitutional tendency to anæmia, scrofula, gout, or obesity must be considered.

Leucorrhœa includes many varieties, and may be the result of different morbid conditions, general and local. The simplest

varieties are vulvar and vaginal leucorrhœa, both more or less of the nature of catarrhs. If these affections do not yield to ordinary home treatment, muriated-alkaline waters, such as those of Ems, La Bourboule, Saint-Nectaire, &c. can often be used with benefit ; if constipation is associated with them, the muriated waters are preferable, and in anæmic complications recourse may be had to iron waters. Well-arranged hydrotherapeutic treatment is likewise often useful. Tonic climates ought, if possible, to follow the course of waters. The cervical, and still more the intra-uterine and the tubal leucorrhœas, are much less adapted to balneotherapeutic treatment, excepting in so far as the treatment can remove abdominal congestion (muriated waters, and amongst the alkaline-sulphated, Franzensbad and Elster), or can do good by improving the condition of the blood (iron waters), or by allaying pain and hyperæsthesia (simple thermal and gaseous thermal muriated waters).

The majority of **diseases of the uterus** are not suitable to spa-treatment. All acute conditions ought to be excluded, and not less so prolapse and other displacements, unless the latter are due to a slightly relaxed condition of the parts ; in this latter case, in stout persons, the sulphated alkaline waters and 'moor baths' of Franzensbad are sometimes attended with success ; in anæmic persons the internal use of iron waters with gaseous chalybeate baths or the muriated waters. Many chronic affections of the uterus and annexes are, as Dr. T. M. Madden¹ insists, dependent upon, or associated with, some constitutional gouty or scrofulous taint. These, as well as anæmia and functional nervous affections when present, can often be combated by suitable mineral waters and spa-treatment. In imperfect involution after confinements and abortions, in chronic endometritis, metritis, and the remains of perimetritis and pelvic cellulitis (parametritis and periparametritis) the cautious use of the muriated waters, such as Kreuznach, Woodhall Spa, Kissingen, Châtel-Guyon, Reichenhall, &c. and muriated-alkaline waters, such as Ems, Royat, Saint-Nectaire, &c. with long rest of the affected parts, is frequently attended with benefit. At any rate muriated waters (including their use in the form of hot baths), such as those of Kreuznach and Woodhall Spa, have obtained a reputation in many chronic inflammatory conditions of the female pelvic organs. They help to promote the absorption of the products of previous inflammation and, as will presently be pointed out, they often diminish the congestive troubles associated with fibromyomata of the uterus. In feeble subjects simple thermal spas (Plombières &c.) may be useful. Occasionally, after one of these various classes

¹ *The Scalpel*, April 1897.

of waters, iron waters (Spa, Schwalbach, Pyrmont, &c.) are to be recommended for secondary treatment.

In fibroid tumours of the uterus, Kreuznach has enjoyed a great reputation. It is at first sight difficult to understand how muriated waters and baths can really exercise good effects on these tumours, but many unbiassed gynecologists (amongst them the late Dr. Matthews Duncan) have assured Sir H. Weber of great benefit again and again derived by their patients from this treatment, especially by diminution of the menorrhagia. Such experience must be accepted, and the facts may be explained by the improvement of the circulation in all the abdominal organs, including the uterus, and by absorption of inflammatory products around the tumours. There is no evidence, however, of the complete disappearance of a fibroid tumour through spa treatment, previous to the entire cessation of menstruation.

Habit of Abortion and Sterility.—In all cases, of course, causes such as anæmia, syphilis,¹ the presence of endometritis, and a chronically congested state of the uterus must be looked for, and in some cases spas and climates may take a share in the removal of such causes. We need scarcely refer to the necessity for rest and the avoidance of mental excitement when there is a tendency to abortion, and the possible advantages of a quiet health resort in such cases. In the intervals between the pregnancies hydrotherapy or spa-treatment may be tried. Thus, repeated courses of the Nauheim treatment, assisted by long rest for the uterus, have apparently overcome the tendency to miscarriage (H. Weber) in cases associated with cardiac weakness. In sterility balneotherapeutic treatment may sometimes have a directly favourable local action (for instance, at Ems) by curing leucorrhœa, endometritis, &c., and thus correcting the acidity and abnormal qualities of the secretion by which the spermatozoa are destroyed. The relief of the constitutional disorder and the improvement of the general health may account for the good result of visits to health resorts in many cases. Sir H. Weber has seen good results follow treatment by various climates and mineral water health resorts, and is inclined to attribute them to the improvement in the general health of the patients, to the long separation from the husbands and the consequent rest of the sexual organs, and to increased vigour on the part of the husbands due to abstinence. Horrocks² lays great stress on the influence of

¹ The antisyphilitic treatment of the pregnant mother, as recommended by J. A. Fournier and others (which is likewise an antenatal method of treating the offspring), can of course be carried out at the various spas referred to under the heading Syphilis in Chapter XXXII.

² Peter Horrocks, 'Lecture on Sterility,' *Lancet*, London, January 9, 1904, p. 70.

warm climates in increasing ovarian activity and in developing the sexual instincts, and it is notorious that, other influences apart, menstruation tends to commence earlier and be more profuse in tropical and subtropical climates than in temperate and cold ones.

Disorders of the Menopause.—We have already referred to this subject under the heading ‘Climacteric Period in Women’ in Chapter XXXII.

CHAPTER XXXIX

DISEASES OF THE NERVOUS SYSTEM AND OF THE EYES AND EARS

DISEASES OF THE NERVOUS SYSTEM

THE majority of organic affections of the nervous system, such as hemiplegia resulting from cerebral hæmorrhage and thrombosis, and paraplegia due to 'myelitis,' can seldom be much improved by climates and health resorts; but the powers of resistance in this class of patients are mostly lowered, and they often require warm winter resorts. In fact, in such cases, as in all others in which one has to do with permanently damaged organs, protective treatment ('*Schonungstherapie*') is of the first importance. The general health in old hemiplegic cases requires special attention, and a tendency to constipation, plethora, and circulatory disturbances can sometimes be favourably influenced by a judicious course at mineral water health resorts during summer. A certain amount of exercise in these cases is important for maintaining the activity of the various organs, but the amount and kind of exercise requires individual consideration, and special attention is naturally likely to be directed to this matter by medical men at health resorts greatly frequented for organic diseases of the nervous system (such as Oeynhausen in Germany, and Lamalou and Bourbon-l'Archambault in France). The simple thermal baths are beneficial by improving the general health and regulating the circulation, and similarly the weak thermal muriated baths of Bourbon-l'Archambault have an old reputation. The sulphated and sulphated-alkaline waters have a certain amount of preventive value when employed in plethoric persons in whom a tendency to apoplexy is suspected. In patients with a slight amount of paraplegia remaining from spinal 'myelitis' mineral water health resorts are sometimes employed according to individual indications with a view to promoting the general health, and the gaseous thermal muriated baths of Oeynhausen are frequently visited for such conditions. In regard to insular sclerosis and amyotrophic lateral sclerosis there is nothing special to be said. We shall refer further on to tabes dorsalis and general paralysis. In

the remains of infantile paralysis, tonic treatment by brine baths and sea air may sometimes be useful. When organic diseases of the nervous centres are due to active syphilitic changes, treatment at mineral water health resorts (see under the heading 'Syphilis' in Chapter XXXII) may in certain cases have advantages over the ordinary treatment at home.

Epilepsy.—We need here merely mention that quiet rural life with suitable occupation for the mind and body in a healthy, not too stimulating, inland locality, is to be preferred. Sanatoria and homes for epileptics in suitable country districts have the advantage that the patient is kept under medical supervision, that suitable occupation is provided, that the value of drug treatment in the individual case can be more readily estimated, and that severe accidents on the occurrence of the fits are less likely to occur in the grounds of such institutions than in the crowded thoroughfares of large towns and when the patient is left completely to himself. For the poorer classes, rural 'Homes' and agricultural 'Colonies' for epileptics have the additional advantage that the patient can be occupied usefully and can help towards earning a livelihood.

Hysteria.—In young patients with an hysterical tendency mental overwork and town life are often most injurious. Localities in the country should be selected according to the patient's constitution, where a quiet life can be led and the patient kept employed for the greater part of the day at some open-air occupation. Children of hysterical and nervous stock should be brought up in the country and given healthy open-air occupation, and their powers of will and self-control encouraged.

In hysterical persons, associated conditions, such as dyspepsia, constipation, and anæmia, when present, can be treated by the measures mentioned under these headings. Functional nervous troubles in torpid individuals without irritability may sometimes be benefited by the judicious use of sea air and sea-bathing or by tonic hydrotherapeutic treatment. When there is a condition of irritable weakness of the nervous system a course of treatment during summer at some simple thermal spa, such as Schlangenbad and Plombières, may sometimes be recommended, and during winter a resort sufficiently warm and sheltered for much time to be spent in the open air.

Hypochondriasis.—Conditions in which a patient is depressed and absorbed in his own real or imaginary ailments are often very hard to treat. His thoughts constantly revert to himself and his peculiar feelings, and the significance he attributes to them. Such a man requires constant reassurance by persons in whose opinion he has confidence, and he feels most happy when he is

within easy reach of such persons. In the selection of health resorts for such patients the personal influence of the local doctor has especially to be considered. Employment in travelling with judicious friends and encouragement in an absorbing occupation are amongst the best means of treatment. In every case a search must be made for some physical condition which may be disturbing the general health, and, when present, disorders such as constipation, hæmorrhoids, or dyspepsia, or a gouty tendency, can to some extent be remedied by health resorts, according to the indications already mentioned under the proper headings.

Mental overwork, 'brain-fag,' and mental depression.—
'Brain-fag' resulting from the fatigue and worry of business or professional occupation and social life in towns is of course often relieved by a simple holiday with open-air life in the country and the mental rest and recreation accompanying it. The amount and kind of exercise is, however, often important. Some men, especially those who in earlier life were devoted to open-air sports, think that they can immediately change from a perfectly sedentary mode of life in town offices, to one of alpine climbing or other strenuous muscular exercise in the country. But this procedure is not always safe and, apart from temporary inconveniences, may lead to grave results when, unknown to the patient, there are degenerative changes commencing in his cardio-vascular system. In any case two weeks or so should be occupied in gradually and comfortably getting into training before the more violent forms of exercise, such as high mountain ascents, are attempted. The same of course applies more or less to nearly all open-air pursuits and sports, rowing and boating, riding and hunting, shooting, fishing, swimming, cricket, lawn-tennis and golf. Other persons think that open-air with eating and drinking is all they require, but lolling about on a ship or at sea-side resorts taking abundance of food but practically no muscular exercise, often leads to disagreeable 'biliousness,' rheumatic pains &c. On the other hand, a long sea-voyage is sometimes the best way of keeping a man away from his business and other worries. When brain-fag is connected, as it not rarely is, with chronic disorders of the organs of digestion and metabolism (whether induced or not by overeating and obvious dietetic errors), gouty and painful rheumatic affections, anæmic, plethoric or glycosuric conditions, obesity, pulmonary emphysema with tendency to bronchitis, or chronic disorders of the cardio-vascular system, special health resorts and climates are frequently required which should be selected according to the time of year and the individual indications (see the indications given under the headings of the various diseases and morbid conditions in Part III). In regard, however, to spa-treatment in

cases complicated by brain-fag, with or without actual 'break-down,' it must be remembered that the three weeks or so occupied by the course of baths or mineral water treatment at the spa itself, even if one were to regard them as a period of rest and recreation for the mind, would not be as long a holiday as the condition of the patient's nervous system in such cases renders advisable. In these cases an 'after-cure' (see Chapter XXVIII) at a suitable climatic resort has to be prescribed because, apart from other reasons, the patient ought to be kept away from his work and ordinary mode of life for a longer time than the period occupied by the actual spa-treatment.

Mental depression, especially when it is caused by overwork or the debilitating effects of influenza and other infectious diseases, is frequently benefited by change of climate. In some cases the treatment is merely that already referred to under 'Convalescence.'¹ In overworked persons of strong constitution, mental depression will often disappear as a result of a long stay in mountain climates. For weaker persons lower elevations in mountainous districts may be recommended for the summer, and during the colder months resorts such as Castellammare-di-Stabia, Sorrento, and Amalfi in Southern Italy, and various resorts in Sicily and on the Riviera and in Spain; and sometimes still warmer climates, such as Algiers, Egypt, and the Canary Islands. Mere change of scene and surroundings is often useful, such as is obtained by travelling among places of historic interest or by a winter spent in Rome, Florence, Venice, or Athens. Needless to say, whenever a tendency to suicide is suspected the patient must be accompanied by proper attendants whatever climatic advice be given, and in such cases sea voyages should not be recommended.

Neurasthenia.—The symptoms and exciting causes of neurasthenia vary too much and form too large a subject for discussion here. In the treatment prolonged change of climate and surroundings is generally of great importance. Alpine resorts may be recommended during summer and in winter too when the general strength is fairly good. In weaker individuals, the winters if possible should be spent in warmer climates. There is perhaps a better chance of obtaining a good result when the neurasthenic condition has followed obvious mental overwork or excessive worry or anxiety of some kind than when it occurs without any very obvious exciting cause. In all cases, however, it should be remembered that the affection is a chronic one, and demands a very long time (sometimes years) for its treatment; also that the condition is, as the name 'neurasthenia' signifies, one of debility of the nervous system; that therefore all causes of

¹ See Chapter XXXII.

mental fatigue and excessive excitement are absolutely contra-indicated.¹ Attempts 'to work off the depression' by going out to dinners and to social entertainments, which are sometimes recommended by the patient's friends, may be most injurious, and in some cases even the exertion and excitement of gentle travelling may be too much for the nervous system. Rest on a couch during part of the day is advisable in many cases, and this may with advantage be carried out in association with a modified 'open-air cure,' as it is at many of the sanatoria for the treatment of pulmonary tuberculosis. From the auto-intoxication point of view the digestive system and the metabolism require special attention. A modified 'Weir-Mitchell treatment' may be combined with open-air treatment in some cases.

General Paralysis.—The early symptoms of general paralysis of the insane can sometimes from a hasty examination be mistaken for hypochondriasis or neurasthenia. In cases of general paralysis, however, travelling is not likely to be of much good, and it is quite possible that the excitement of voyages and travelling may sometimes accelerate the progress of the disease.

Tabes Dorsalis.—This disease, although undoubtedly generally due to syphilis as a predisposing cause, is often excited by over-fatigue and exposure to cold and wet weather. In some instances (H. Weber) which have remained stationary for more than twenty years, the use of thermal baths in summer and yachting during winter in sunny climates, including the Nile, seem to have acted beneficially. The so-called lightning pains and other pains and paræsthesias are certainly not rarely mitigated by simple thermal spas and hydrotherapeutic measures. Very hot baths seem to be contra-indicated in most cases at all events, but the moderately warm baths of Lamalou in France, and of Oeynhausen in Germany, have obtained a considerable reputation. Occasionally antisyphilitic measures (mercurial inunction combined with thermal baths and douches), as carried out at Aix-la-Chapelle and other health resorts, yield good results. The methodical movement exercises introduced (1890) into the therapeutics of tabes by Dr. Frenkel, of Heiden, in Switzerland, are acknowledged to be often of some use in diminishing the amount of inco-ordination, and are now employed at various health resorts to which this class of patients resort. This treatment when adopted under medical supervision in favourable chronic and quiescent cases, causes the patients to more or less overcome their ataxy by making more use of what is left to them of their muscular and other senses,

¹ Often there is a condition of 'irritable weakness,' that is, a condition in which the nervous centres are abnormally irritable, though they too rapidly become exhausted by any exertion.

especially the sense of sight; patients may possibly in this way also regain control over their movements by gradually learning to correctly interpret some of their altered muscular sensations. In a sense, therefore, the object of the treatment is to compensate for the deficiency and abnormality in sensation (to which the inco-ordination of movements is due) by further methodical education under medical supervision of the senses which remain to them, particularly by the careful use of their eyes. In this method of treatment, however, as well as in baths and hydrotherapeutic processes, all fatigue must be absolutely avoided. Prolonged stays at mountain health resorts of not very great elevation during summer (such as St. Beatenberg, Gurnigel, Les Avants, Château d'Oex) mostly exercise some beneficial effect.

Neuritis and Neuralgias.—In cases of multiple peripheral neuritis (polyneuritis) following infectious diseases, such as typhoid fever, health resorts selected according to the patient's constitution and the season of the year may favour convalescence from the infectious disease, whilst the careful use of simple thermal baths and thermal sulphur baths and douches and massage may be of use in promoting recovery from muscular atrophy and contractures due to the peripheral neuritis.

'**Sciatica,**' '**brachialgia,**' and similar¹ affections involving other nerves are generally due to a kind of neuritis, and although the motor nerve-fibres are not usually sufficiently involved to produce paralysis, a severe attack is frequently associated with a certain amount of muscular atrophy, anæsthesia, various paræsthesias, and alteration in the deep reflexes. In all the severer forms rest is required at first, and massage, douche-massage, and forcible douches must be absolutely abstained from during the acute period. After the acute stage is over, health resorts where hot mineral water baths or hot hydrotherapeutic measures can be obtained are useful.

The simple thermal waters, the thermal muriated waters, the thermal sulphurous waters, and the thermal muriated sulphurous waters are very frequently employed for baths and douches in these cases, but cold muriated and other waters artificially heated are likewise made use of. Hot douches, alternating ('Scotch') douches, and the douche-massage form a chief part of the treatment at many health resorts. The applications may be confined to the affected part, or, though specially directed to this part, may be likewise applied to other parts of the body, in order that a greater

¹ It is perhaps the custom to speak of cases as '*sciatica*' even when other nerves of the lower extremities besides the great sciatic nerve are affected, sometimes even when other nerves are alone affected. '*Brachialgia*' is the general term for analogous affections of nerves in the upper extremities.

constitutional effect may be derived from the treatment. Amongst the many health resorts at which such methods of treatment are provided we may mention Aix-les-Bains, Aix-la-Chapelle, Uriage, Bourbonne, Harrogate, Bath, Wildbad-Gastein, Wildbad in Württemberg, Baden-Baden, Ragatz, and Baden in Switzerland. It is scarcely necessary to refer to the local hot vapour baths, hot air baths, and the electric light forms of hot air baths ('radiant heat baths'), which are often most useful and are employed at many health resorts.

A constitutional gouty tendency is frequently present in cases of sciatica &c. and may be treated by climates and spas according to the indications we have given under the heading 'Gout and Gouty Conditions' in Chapter XXXII. The eliminative action of balneotherapeutic and hydrotherapeutic measures certainly plays a part in the results obtained in gouty cases, allied to which are cases occurring in glycosuric and obese individuals (see sections on Diabetes and Obesity in Chapter XXXII).

We may here add that in regard to climatic and balneotherapeutic treatment, as well as other methods of treatment, it is important to distinguish cases of neuralgic pains and paræsthesias due to tabes dorsalis and organic affections of the central nervous system.

The severest and most typical forms of *trigeminal neuralgia* ('tic-douloureux') are not likely to yield to treatment by climates and health resorts, and permanent cure seems to be rare even by the most radical surgical treatment. In the ordinary minor forms of facial neuralgia a constitutional predisposing cause, such as anæmia or debility following overwork or acute diseases, is frequently present, even when some obvious peripheral exciting cause, such as a decayed tooth, is discovered. Treatment by climates and health resorts (Chapter XXXII, 'Anæmia and General Debility,' 'Convalescence from Acute Diseases') is frequently useful in these cases, though, of course, any exciting cause of the neuralgia, when present, should be remedied. Neuralgia of the supra-orbital division of the trigeminal nerve, when it is associated with chronic malaria ('brow-ague'), may sometimes be benefited by treatment at chalybeate and arsenical spas and by long residence at climatic health resorts of high altitude (see Chapter XXXII, 'Chronic Malarial Affections').

Backache (chiefly of the sacral region) is a very common complaint in women with disorders of the pelvic viscera and chronic constipation. Appropriate treatment at mineral water health resorts may sometimes be of use by relieving the chronic constipation and counteracting the tendency to congestion of the pelvic viscera. Anæmia is frequently a predisposing cause of

'backache,' and we refer to what we have said under that heading. For Lumbago and Rheumatic Pains see Chapter XXXII.

Graves's Disease, Basedow's Disease, or Exophthalmic Goitre.—For most cases, and for all the acute and severest forms, perfect rest and quiet are indispensable, and removal to health resorts is not to be advised. In chronic cases, however, residence in elevated regions sometimes gives good results. S. H. Solly¹ thinks that any undue exertion is more likely to have an unfavourable effect on patients with Graves's disease at high altitudes than at low ones; but if fatigue is avoided, long residence extending over many months and years not rarely exercises a curative influence. According to F. Jessen,² patients with Graves's disease, if the heart is not too much affected, are sometimes completely cured by residence at high altitudes.

In mild forms of Graves's disease and in allied vasomotor disturbances, the soothing effect of treatment at simple thermal spas, such as Schlangenbad, &c., and the tonic effect of gaseous thermal muriated baths (as Nauheim) may be beneficial, and the removal from the excitement and worries of home life is often likely to aid the spa treatment. In some minor forms and in chronic cases the careful use of hydrotherapeutic measures, massage, Swedish gymnastics, and Schott's resistance exercises can likewise be employed, according to individual indications. The lesser symptoms of Graves's disease connected with pregnancy and various temporary conditions of the sexual organs in women require generally no special treatment by climates or mineral waters.

Goitre.—Ordinary goitre is mentioned next to exophthalmic goitre for convenience. It has been suggested that the comparative immunity of seaside places is due to the inhalation of minute quantities of iodine salts derived from the spray of sea water in the air. The 'want of iodine theory' of goitre, as originally suggested, has been disproved, but some indirect action of iodine salts is generally acknowledged, and pharmaceutical preparations of iodine are largely employed in the treatment of the disease. Some iodine-containing mineral waters had formerly a reputation against goitre, and that of the Tassilloquelle of Hall, in Upper Austria, was known as the 'Haller Kropfwasser' ('goitre³-water' of Hall); similarly, the waters of Rothenbrunnen in Switzerland have an old local reputation in the treatment of cretinoid

¹ *Transactions of the American Climatological Association*, vol. xiii. p. 245.

² *Muenchener med. Wochenschrift*, August 29, 1905, p. 1676.

³ Unless, indeed, the German word 'Kropf' was formerly often used to signify not goitre, but scrofulous glands in the neck and under the jaw.

and backward children. Fresh attention has been given to the possible therapeutic action of minute quantities of iodine¹ compounds since the discovery by E. Baumann, in 1896, of thyroiodin ('iodothylin') as the active principle to which the substance of the thyroid gland owes at least part of its power against myxœdema and cretinism. In this connection it is interesting to note that the iodine found in traces in sea air appears, according to the researches of Armand Gautier, to exist there in organic combinations, and may belong to minute organisms or fragments of organisms held in suspension in the air. However, practically speaking, all that need be said on the climatic treatment of goitrous patients is that they should reside in a locality where goitre is not endemic, and where they can obtain good drinking water and abundance of light and sunshine.

Myxœdema is likewise for convenience mentioned here. A warm, sunny, not relaxing climate would undoubtedly be indicated for these patients, were it not that the recent discovery of the specific effect of thyroid treatment has rendered climatic measures quite subordinate in almost all cases. In regard to infantile myxœdema (cretinoid conditions), it is interesting to note that the waters of Rothenbrunnen, in Switzerland, containing small amounts of iodine and iron, have, as already mentioned, enjoyed an old well-attested local reputation in the treatment of cretinoid and 'backward' children.

Diabetes Insipidus.—When this form of polyuria is merely functional, climatic health resorts and simple thermal spas at high elevations may have a beneficial effect, owing to their tonic influence upon the general health and the functions of the nervous system. Chalybeate and arsenical spas may likewise sometimes be useful when there is anæmia.

Spasmodic Asthma.—This affection has already been considered under Diseases of the Respiratory Organs (Chapter XXXIV).

Chronic or Recurrent Headaches.—There are many different causes of headache, and some of them can be remedied by climates and health resorts. In headaches due to anæmia and causes of debility, such as long-continued leucorrhœa, treatment at chalybeate, muriated, and simple thermal spas, and, in slight

¹ In the same way that fresh interest has been given to minute quantities of arsenic in mineral waters since the discovery announced by Armand Gautier, in 1899–1900, that arsenic in organic combination is a normal constituent of the thyroid gland, and even of some other parts of the body. Hödlmoser (*Zeitschr. für phys. Chemie*, vol. xxxiii.) and Czerny (*Zeitschr. für phys. Chemie*, vol. xxxiv.) made similar investigations, but could not confirm Gautier's results. They found that the presence of arsenic in the animal body was not constant. In regard to iodine, it may be noted that Bourcet has found it in other parts of the body besides the thyroid gland.

cases, climatic resorts of high altitude, are often beneficial, but we must refer to the indications already mentioned under the heading 'Anæmia and General Debility.'¹ In the headaches after influenza and other infectious diseases, health resorts may be useful as indicated under the heading 'Convalescence from Acute Diseases.' In gouty and so-called 'rheumatic' subjects suffering from headache, dry inland climates of medium elevation may frequently be useful during summer, and warm dry resorts, such as Egypt, during winter. The eliminative methods of spa-treatment may often be of use associated with judicious regulation of diet and exercise (see under heading 'Gout and Gouty Conditions'). Dyspepsia, catarrhal conditions of the alimentary canal, and constipation² are frequent causes of head-

¹ See Chapter XXXII for the sections referred to on anæmia, convalescence, and gouty conditions.

² It cannot be doubted that the absorption of toxins, produced in the alimentary canal (one form of auto-intoxication), often takes a leading share in the production of headaches, irritability, lassitude, and so-called 'biliousness,' both when constipation is present and when it is not, and especially when there is constipation combined with some abnormal condition of the intestinal mucous membrane. In the latter cases the toxins are absorbed not so much owing to the stasis of the contents of the bowels as owing to some catarrhal or other abnormal condition of the mucous lining facilitating abnormal absorption. (In regard to this subject compare our remarks in the section on Habitual Constipation in Chapter XXXVI, and the footnote to that section regarding the connection between constipation and symptoms of auto-intoxication.) This explains why in cases of long lasting retention of fæces in the large intestine (as from simple impaction of hard fæces or from the rare 'idiopathic' dilatation and hypertrophy of the large intestine) there probably need be no toxicæmic headache or great excess of indican in the urine, whereas in cases of diarrhœa (notably in cases of the so-called 'English Cholera') with intestinal catarrh, the urine certainly often gives undoubted evidence that products of decomposition are being absorbed from the intestines. The exact nature of the toxins, and fermentations giving rise to them, and the conditions which favour these fermentations, are still imperfectly known, though with regard to the question of diet more complete knowledge on these points would be useful. Excessive fermentation in the bowels is doubtless often due, not so much to the exact quality of the ingesta, as to excessive quantity. If the amount ingested is excessive, though the intestinal secretions may be normal, they are yet relatively insufficient for the quantity of food. Open-air exercise may remedy such states of affairs without any alteration in diet, either by improving the circulation in the mucous membrane and thus indirectly allaying catarrh, and checking the undue fermentation, or by aiding the oxidation and excretion of the toxins after their absorption, or likewise by a favourable action on the circulation in and function of the central nervous system. Often the mere decrease in the total amount of the food, and the eating it more slowly (for more perfect mastication the dentist's assistance is naturally sometimes required) and at more regular intervals, may suffice to check the abnormal fermentation. In other cases the diet has to be modified to suit the individual digestive and metabolic peculiarities of the patient. The temporary change from a chiefly carbohydrate diet to one consisting mostly of proteids and vice versâ probably partly acts by giving temporary physiological rest to certain groups of cells concerned in the nutrition of the body (compare article by F. P. Weber in *Treatment*, 1897, vol. i. p. 444), or by at least altering the kind of work which these cells have to do. That the physiological activity of secretory cells in the alimentary canal is qualitatively altered by a change in diet is shown by the experiments of Professor J. P. Pawlow and Dr. A.

ache, and may be treated on the principles suggested under these headings. Other abdominal disorders, such as imperfect action of the liver and kidneys, may, by producing a toxæmic condition, give rise to headaches; these cases must be treated on general principles, but in the slighter forms climates, baths, and mineral waters are serviceable by their eliminative action, and in certain instances warm dry winter climates diminish the functional strain thrown on the affected organs. The reflex irritation set up by chronic affections of the pelvic organs is not rarely a cause of headache. Chronic congestion of the pelvic viscera appears sometimes to be relieved by a residence at high altitudes, and this treatment may get rid of the headache in certain cases, although at the same time occasionally aperient remedies must be called into service; for the headaches associated with dysmenorrhœa we must refer to the heading 'Disorders of the Sexual System in Women' (see Chapter XXXVIII).

Many headaches seem to be due partly to venous congestion within the cranium and to imperfect aëration of the blood, and partly to a toxæmic condition from defective metabolism and imperfect elimination. Insufficient muscular exercise and indoor occupations, with mental strain and too much food, frequently produce headaches of this class. The obvious treatment in such cases is to limit the diet, and increase the amount of open-air exercise by walking, riding, cycling, lawn-tennis, &c. In these cases open-air exercise exerts its beneficial effect, not only by promoting the oxygenation and circulation of the blood, but by rendering metabolism more perfect and complete, and favouring the oxidation of toxic substances in the blood. In fairly strong subjects of this class a holiday in mountain districts of medium or high elevation, with judicious climbing exercise, has an

Walther, who have proved that in dogs both the gastric and the pancreatic secretions vary quantitatively and qualitatively according to the amount and kind of the food. (See J. P. Pawlow, *Die Arbeit der Verdauungsdrüsen*, A. Walther's German translation from the Russian, Wiesbaden, 1898; or the English translation by W. H. Thompson, London, 1902; see also W. Fleiner, *Lehrbuch der Krankheiten der Verdauungsorgane*, Stuttgart, 1896, p. 199). Brunton thinks that the beneficial effect of a sudden change in diet may be due to an action on parasitic microbes in the intestine, these latter failing to adapt themselves to their changed surroundings and being actually 'starved out' (Lauder Brunton, 'On Constipation and Diarrhœa,' *Lancet*, May 30, 1896). A very similar explanation is suggested by G. Thin (*Brit. Med. Journ.*, 1897, vol. ii. p. 1636) to account for the wonderfully beneficial action of a milk diet in certain cases. He thinks that in such cases the harmful diet forms a better pabulum for some abnormal kind of fermentation in the bowels. Hirschler's experiments also tend to show that a sort of antagonism exists between carbohydrate and albuminous (putrefactive processes) fermentation in the intestines; and Ortweller ascertained that an indican reaction in the urine caused by albuminous fermentation in the intestines, could be made to disappear when plenty of carbohydrate food was given (see F. Müller, in von Leyden's *Handbuch der Ernährungstherapie*, 1897, vol. i. p. 215).

admirable effect; and in many cases an ordinary walking tour is all that is required. Care must, of course, be taken to avoid over-exertion at the commencement. In stout and plethoric persons of the same class who, owing to indolence or obesity, cannot readily obtain sufficient ordinary open-air exercise, a course of treatment at sulphated alkaline spas, such as Marienbad, Karlsbad, Tarasp, Elster, may be recommended, especially when there is a tendency to constipation; the spa-treatment in these cases may often with advantage be combined with massage and Swedish gymnastics. In other cases when the state of the cardio-vascular system is not quite perfect, similar methods may be recommended, sulphated alkaline spas being chosen in the stronger patients, and muriated spas, such as Kissingen and Homburg, in the less robust subjects. Headaches associated with chronic asthma, chronic bronchitis, and dilatation of the heart, belong more or less to this group in regard to the exciting causes of the pain, but for the treatment we must likewise refer to what we have already said in discussing Disorders of the Respiratory and Circulatory Systems (Chapters XXXIV and XXXV). According to G. W. Ross¹ certain forms of chronic headache, most frequently met with in women, are associated with diminished coagulability of the blood and are relieved by calcium salts. It is possible that in such cases the internal employment of mineral waters of the alkaline earthy group (Chapter XXVI) or of other mineral waters rich in calcium salts (cf. p. 348) might be useful, together with the addition of a considerable quantity of milk (on account of the calcium salts it contains) to the diet.

In headaches connected with chronic alcoholism and the habitual abuse of tobacco, treatment of digestive disturbances, together with abstention from the exciting cause, is indicated; simple thermal baths and climates of moderate altitudes during summer, and warm dry winter resorts, may sometimes be useful when it is suspected that the alcoholism has already led to chronic changes in the brain or meninges.

Migraine (sick headache, bilious headache) is not rarely relieved by improvement of the general health (with rest from brain-work, and open-air life) at climatic health resorts. This is especially the case when the migraine has been induced or aggravated by mental overwork, sedentary indoor life, and a too nitrogenous diet. Mountainous climates of medium elevation, with a moderate amount of climbing exercise and much time spent in the open air, are often to be recommended; but in some persons, especially when there is habitual constipation, a course of treatment at sulphated alkaline spas (in plethoric subjects) or at

¹ 'On the Relief of Certain Headaches by the Administration of One of the Salts of Calcium,' *Lancet*, January 20, 1906, p. 143.

muriated spas (in less robust subjects) ought to precede the climatic treatment. Limitation of meat and alcohol must generally be insisted on, and in many cases a tendency to migraine may be treated according to the suggestions given under the heading 'Gout and Gouty Conditions' in Chapter XXXII.

Chronic headache or the tendency to headache following excessive mental work, shock, worry, and insomnia, is often relieved by climates and health resorts. Inland localities at medium elevations may be recommended at first, and higher elevations afterwards. The amount of exercise must be limited until the general condition begins to improve; afterwards climbing exercise is frequently useful, if the organs of circulation are healthy. In a great number of cases, especially in men who are 'good sailors,' a sea voyage answers admirably, and has the advantage of effectually getting rid of the fatigue of reading and answering letters.

Neurotic, neurasthenic, or nervous headache is a convenient term for a chronic or recurrent headache for which there may be no obvious exciting cause, but which sometimes is originally started by overwork, worry, insomnia, or acute diseases, especially in persons of weak constitution and of a nervous temperament. This headache may be intermittent at first, and afterwards become persistent.¹ A judicious change of climate, together with change of social surroundings, is likely to have a good effect if persisted in for a long time. Simple thermal spas at moderate elevations (Gastein, Wildbad, Buxton, &c.) may often be selected for the summer, and warm equable climates for the winter, but no fixed rules can be laid down, and more bracing places may be preferable in some instances. Careful hydrotherapeutic methods are likewise sometimes useful.

Deficient Sleep (Insomnia).—The causes of chronic insomnia are very various. Long-continued brain-work and anxiety are amongst the most frequent. In these cases the insomnia may at first be voluntary, owing to sitting up for literary or scientific work, or to nurse sick persons, but may after a time become a disagreeable habit, difficult to break. In fairly strong persons residence at high and medium altitudes (such as the Engadine, Rigi-Sheideck, Gurnigel, and St. Beatenberg) may quickly drive away the insomnia; in weakly persons a course of treatment at simple thermal spas of medium elevations, during summer, may be recommended, and a warm climate, such as Algiers, Egypt, the Bay of Naples, or the Riviera (especially Grasse), during

¹ With such chronic neurotic headaches it is conceivable, however, that the rare form of headache due to chronic simple internal hydrocephalus in adults might be confused.

winter. A judicious course of hydrotherapeutic treatment at one of the numerous health resorts where this can be obtained is often all that is required. If the sufferer be of the male sex and a 'good sailor,' a long sea voyage may be the most agreeable and the most efficient mode of treatment.

For cases of insomnia connected with anæmia and general debility, convalescence from acute diseases, and neurasthenia, we must refer to these headings.

Other cases of insomnia are due to dyspepsia, intestinal catarrh, and constipation, and for the treatment we must refer to these headings, whilst the treatment in another class of cases is that for asthma, chronic bronchitis, and dilatation of the heart. For the disturbed sleep and restlessness sometimes associated with the degenerative changes of old age we refer to the heading 'Old Age and Premature Old Age' in Chapter XXXII. In many patients of sedentary habits, in those accustomed to too much alcohol, and in many chronic gouty and *toxæmic conditions*, hydrotherapeutic and eliminative measures are likely to give better sleep than any narcotic drugs.

Obvious exciting causes of insomnia, when present, must of course be as far as possible avoided, such as too late meals, too late mental work, sleeping after meals during the daytime and in the evening, pruritus (with or without cutaneous eruption), and the abuse of tea or coffee.

The amount of sleep required varies much in different persons. Occasionally want of sleep is complained of when it is found that as much is obtained as the age and habits of the patient require.

Excessive sleep, though less distressing than defective sleep to the patient himself, is sometimes of equal or greater importance. Adults seldom require more than seven or eight hours' sleep, but many exceed this limit, and by excessive sleep diminish metabolic changes and the excretion of waste products, thus encouraging a tendency to obesity, biliousness, and gouty disorders, and to early degenerative changes in the cardio-vascular system. The habit of sleeping too much must therefore be combated. Excessive sleep is often met with in gouty and plethoric subjects, who eat and drink freely, or in whose families a tendency to cerebral apoplexy is supposed to exist.¹ Such

¹ This tendency to excessive sleep and to uncontrollable attacks of sleep in gouty and plethoric persons is sometimes termed 'narcolepsy.' It is of course quite distinct from the attacks of excessive sleep more fitly termed narcolepsy known to have occurred in young persons who otherwise appeared in good health, and from sleep-like conditions associated with hysteria and epilepsy. Somnolence may likewise be a premonitory or early symptom of commencing cerebral hæmorrhage, or may be due to cerebral thrombosis or to syphilitic or other organic disease of the brain. Some-

persons will fall asleep at any hour during the daytime when left alone, especially after meals, and sometimes, if allowed to, will sleep on for three or four hours at a time, in addition to getting nine or ten hours of heavy sleep at night. Plenty of open-air exercise, together with strict limitation of food and drink, is required, and a course of treatment at sulphated alkaline spas (Marienbad, Karlsbad, Tarasp, &c.) may be recommended, or when the condition occurs in leaner individuals, at one of the muriated or muriated sulphur springs (Kissingen, Homburg, Harrogate, Llandrindod, &c.). After the course of waters the patient should be sent for some weeks to an inland climatic resort of moderate elevation, where exercise should be encouraged and much time spent in the open air. Massage and Swedish gymnastics may also be useful in some of these cases.

AFFECTIONS OF THE EYES

The constitutional conditions with which affections of the eyes are associated, or on which they depend, are sometimes more or less amenable to treatment by climates and health resorts. Thus, in persons subject to gouty *episcleritis* or to *scleritis* (anterior sclero-choroiditis, scleritis anterior) or *rheumatic iritis*, constitutional treatment according to individual indications is often required, and mineral waters, baths, or simple hydrotherapy can be made use of at suitable health resorts. In affections of the conjunctiva and cornea occurring in scrofulous and weakly children, treatment of the scrofulous condition by climates &c. (see Chapter XXXIII) may be employed, together with the special treatment of the ocular condition. In other affections of the eyes when there is anæmia, muriated, chalybeate, and arsenical spas may be employed, and in gouty persons a course of treatment at Aix-les-Bains, Wiesbaden, Homburg, &c., and when there is constipation or a plethoric tendency a course of sulphated or sulphated-alkaline waters. In regard to climatic resorts, positions amidst shady woods should be selected (such as the Flimser-Waldhäuser and Gurnigel), sheltered from high winds and removed from the dust and glare of chalky and sandy roads and cliffs. Sea voyages and residence at the seaside are not generally to be recommended on account of the glare of the sea, especially in inflammatory conditions affecting the macular region of the retina, and in photophobia from hyperæmic irritative states of the iris, whether partly of neurotic origin or otherwise.

times the frequent occurrence of uncontrollable fits of sleeping, at quite unusual hours, may constitute the most striking symptom of large cerebral tumours.

AFFECTIONS OF THE EARS

In children and young persons chronic purulent discharges from the middle ear are usually kept up by adenoid vegetations of the naso-pharynx, or by a scrofulous tendency, or general weakness. In addition to local treatment, including removal of the adenoids, the advice given under the heading 'Scrofula' (see Chapter XXXIII) may be recommended according to individual indications. In chronic non-suppurative (dry) catarrh of the middle ear leading to sclerosis and associated with a gouty tendency the indications given under the heading of 'Gout and Gouty Conditions' (Chapter XXXII) may be referred to. When the catarrh occurs in plethoric persons who eat and drink too freely, a course at sulphated alkaline spas may be of use, but the diet and regimen will have to be permanently altered. When habitual constipation and dyspepsia are associated with similar aural conditions, treatment of the constipation and dyspepsia by spas and mineral waters may be serviceable. In catarrhal cases elevated dry and sunny localities should be selected, and damp valleys with clay subsoil should be avoided. Warm well-drained seaside resorts are sometimes recommended in England.¹ Menière's symptoms and disorders of the internal ear are not unfrequently more or less associated with goutiness and chronic dyspepsia, in the treatment of which conditions climates and health resorts may, as already mentioned, play a part. In affections associated with chronic malaria and syphilis, health resorts may sometimes take a small share in the treatment. (See headings 'Chronic Malarial Affections' and 'Syphilis' in Chapter XXXII.) Occasionally various disturbances, such as vertigo, with or without a kind of agoraphobia and 'functional deafness,' may be associated with hysteria or neurasthenia, and we must refer to these headings for the possible utility of climates and health resorts in such cases. There are various subjective noises and a kind of partial deafness or 'dullness of hearing,' or altered perception of sound, which may occur as symptoms of anæmia or conditions of general debility, such as during convalescence from acute diseases (or in young men after sexual excess), and pass off when the anæmia is treated, and the general health improved, even when they are associated with old organic change of the middle ear, &c.² (See indications under headings 'Convalescence,' 'Anæmia and General

¹ Vide Dr. Urban Pritchard, *Brit. Med. Journ.* November 5, 1904, p. 1206. In regard to seaside resorts in recurrent otorrhæal cases see Passow, 'Balneologie und Ohrenkrankheiten,' *Berliner klin. Wochenschrift*, April 17, 1905, p. 453.

² Cf. R. Lake, 'Weakness of Hearing, or the Effect of General Disorders of the System on Ears already Slightly Diseased,' *West London Medical Journal*, April 1906,

Debility,' in Chapter XXXII.) In regard to tinnitus, however, too much must not be hoped for from baths and climates. In some persons almost every attack of severe coryza and catarrh of the upper respiratory passages is associated with temporary aural disturbance and deafness, and there is a danger of the development of permanent middle-ear disorder, if the tendency to repeated catarrhal attacks be not checked by appropriate climatic and general hygienic measures. In chronic catarrhal conditions of the middle ear, treatment of the nasal and pharyngeal mucous membranes by douches, sprays, and inhalations, such as are employed at many health resorts, may be useful. (See heading 'Chronic Catarrh of the Larynx, Pharynx, and Nose' in Chapter XXXIV). Methods have likewise been devised for the local application (through the Eustachian catheter) of the vapour from thermal sulphur waters (Bagnères-de-Luchon, Cauterets, Ax-les-Thermes, &c.) to the tympanic cavity in various forms of chronic catarrhal otitis.¹

Occasionally the question of the advisability of sea-bathing for persons with ear troubles arises. The repeated impact of the water and the chemically irritating effect of the salt have a tendency to increase (or even produce) aural disturbances,² and patients suffering from chronic affections of the ear or a tendency to aural catarrh should be advised not to bathe in the open sea and not to dive, even in fresh water.

Deafness (especially for very high-pitched tones) and other aural disorders due to the degenerative changes occurring in the ear and nervous structures as the result of senility or premature senility, may to some extent be warded off or delayed by the measures referred to under the heading 'Old Age and Premature Old Age' in Chapter XXXII, especially by the mental influence of travel, visits to historic towns with art treasures and other attractions, and agreeable social intercourse at health resorts. By these means and by the others already mentioned, the functions and structures of the whole body (including those of the aural apparatus) are moderately exercised and prevented from falling by disuse into premature decay.

¹ A. Gouraud originated this plan of treatment at Luchon in 1885, but it has been adopted and developed by de Lavarenne, Audubert, Baqué, Barrié, J. Ferras, and de Gorsse of Luchon, by H. Lajaunie of Ax-les-Thermes, and by Depierris and other doctors of Cauterets. See E. Escat, 'Traitement des Otites chroniques par la Vaporisation tubo-tympanique aux Eaux sulphurées-sodiques thermales,' *Presse médicale*, Paris, July 28, 1906, p. 477.

² Conte (*Arch. de méd. et pharm. milit.*, January 1906, p. 36) gives a summary of cases of otitis media, primary attacks or relapses, due to sea-bathing.

CHAPTER XL

AFFECTIONS OF THE SKIN

CLIMATE does not play a great part in the treatment of most skin diseases. In all cases, however, attention must be paid to any state of the body predisposing to the cutaneous affection. In syphilitic skin diseases the climatic and balneotherapeutic treatment (which we have already indicated for syphilis) act beneficially in addition to the ordinary methods. When associated with anæmia, skin diseases may be benefited by treatment at chalybeate and arsenical spas. When eczema, psoriasis, and pruritus occur in gouty persons, climatic and balneotherapeutic treatment for the gout (see Chapter XXXII) may have a beneficial result on the cutaneous affection. In lupus vulgaris and tuberculous affections of the skin, suitable climates may indirectly exercise good effect by promoting the powers of resistance (see under 'Scrofula' in Chapter XXXIII), but will not take the place of ordinary treatment. When the nervous system is at fault, climates and spas are not rarely useful, partly owing to the change of surroundings and relief from mental worry which they afford. Thus in acne and acne rosacea relief from mental worries, and the improved digestion at the health resort, may greatly diminish the acne. In eczema, likewise, the beneficial effects of change of climate in many cases may be explained in the same way. In all such cases climates and health resorts must be chosen according to individual indications. In overworked persons of fairly strong constitution, dry inland climates of moderate or high elevation frequently suit, whilst in nervous and excitable persons of weak constitution health resorts amidst shady woods in beautiful mountain valleys of low or slight elevation are preferable during summer, and during winter one of the warm seaside winter resorts may be selected.

In the selection of climates for persons peculiarly liable to cutaneous affections, the effects in each case of heat, bright sunshine, glare, strong winds, and cold weather must be carefully considered. Thus, lupus erythematosus is generally made worse by cold winds. In cold weather, especially cold damp weather,

some persons, notably children and young adults (young women more than young men), are peculiarly liable to bad chilblains, and to coldness, swelling and lividity of the hands, which in extreme cases constitutes a form of 'acrocyanosis' induced by the cold (see the section on Bad Circulation in the Extremities, Chapter XXXV). Some cases of eczema are aggravated by cold, especially cold winds, and others by heat and sunlight. We need scarcely refer to the curious cases of summer and winter eruptions due to special idiosyncrasies of the skin, or to the rare and grave disease termed 'xeroderma pigmentosum' (Kaposi's disease), which is greatly aggravated by strong light. In such cases exposure at high altitudes, owing to the excess thereof of the 'chemical rays,' is likely to be specially injurious. In regard to the various effects of exposure to sunshine (and 'chemical rays') on specially susceptible individuals see also the section on the Influence of Light in Part I, Chapter I.

Mineral water health resorts are of special use when there is some obvious gouty or other defect in the metabolism or in the general state of health. In gouty cases the eliminative effect of internal courses of alkaline, muriated, sulphurous, or muriated sulphurous waters is often made use of, and in eczema connected with glycosuria the measures recommended under the heading 'Diabetes' may be serviceable. The simple thermal baths of Schlangenbad &c. may owe some of their beneficial action on the skin to the improvement which they doubtless cause in the circulation through the small cutaneous blood-vessels; their action in atrophic and senile conditions of the skin can therefore be readily explained.¹

The prolonged tepid baths of Loèche-les-Bains, in Switzerland, act in very chronic cases of eczema and psoriasis probably by macerating the epidermis, washing off scales and discharges, and improving the cutaneous circulation. Bathing during four to six hours every day at Loèche-les-Bains leads generally at about the tenth or eleventh day to a peculiar cutaneous reaction (sometimes an actual dermatitis) called the *poussée*, which precedes the disappearance of the eruption. Unfortunately, even when the result is most striking, it is often not permanent. The local effect on the skin of a course of any prolonged baths or salt-water baths is the reverse of sedative, and such treatment can only be recommended in the very chronic non-progressive cases of eczema.

¹ There can be little doubt that in by-gone times simple thermal waters and thermal sulphur waters owed part of their reputation to the ordinary effects of prolonged baths in some parasitic skin diseases, notably scabies. Doubtless, the 'acarus scabiei,' the cause of scabies, was actually drowned by the prolonged bathing, but the results in such cases were probably best when the effect of bathing was assisted by the germicidal action of the sulphuretted hydrogen in the sulphur waters.

and psoriasis which show very little irritability and in which other stimulating local applications (e.g. chrysarobin) and the internal use of arsenic are not contra-indicated. In eczema the spas of Schinznach, Uriage, and Saint-Sauveur have acquired a certain reputation, and in individuals belonging to gouty families Royat and La Bourboule in the Auvergne. Mere change of climate, however, often gives relief in eczema, but cold damp places and windy localities have to be avoided, and sea air often, at first at least, aggravates the eruption. H. G. Adamson points out to us that the various forms of 'seborrhœic eczema' which are readily relieved by local external sulphur applications are also likely to be benefited by balneotherapeutic treatment at sulphur spas. He suspects that some sulphur spas owe their reputation for the cure of eczema in great part to the good results obtained in cases of 'seborrhœic eczema.'

Some cases of troublesome pruritus are connected with an atrophic condition of the skin and cutaneous blood-vessels allied to senility or premature senility. In such cases the climatic indications are similar to those to which we have already alluded under the heading 'Old Age and Premature Old Age' (Chapter XXXII). Warm dry health resorts are preferable during winter, and if possible much time should be spent in the open air. During summer a course of baths at a pleasant simple thermal spa of medium elevation (such as Wildbad, Schlangenbad, Ragatz, the Swiss Baden, or Buxton) will improve the circulation in the cutaneous blood-vessels and induce better nutrition and less irritation in the disordered nerve-endings of the skin. In other cases of pruritus, defective function of the liver and kidneys and derangement of the general metabolism often explain the irritation. In strong and plethoric persons in whom the hepatic functions are supposed to be at fault, Karlsbad and the sulphated alkaline spas may be of use. In other cases simple alkaline, muriated, and simple thermal spas may be given the preference. In some neurasthenic and fatigued individuals with pruritus, a mere holiday with rest and change of climate and surroundings may exercise a tonic effect, and get rid of the itching.

In obstinate eruptions of boils (chronic furunculosis) a change of climate to the seaside or to the mountains can be recommended, or a course at sulphurous, chalybeate, or arsenical spas; in cases associated with glycosuria and mental worry, sea voyages may have an excellent effect. In chronic urticaria a change of climate may likewise be beneficial. When the urticaria is associated with distinctly diminished coagulability of the blood, calcium salts, which increase the blood-coagulability, deserve a trial, according to the views of A. E. Wright. In such cases a diluted

and purified 'Mutterlauge,' rich in calcium chloride, might be employed internally, or one of the mineral waters containing bicarbonate of calcium, together with the addition to the diet of a rather large proportion of milk (owing to its relative richness in calcium salts). In connection with the possible utility of calcium salts we have already alluded to conditions in which there is an exaggerated tendency to suffer from chilblains (see Chapter XXXV).

There is a condition of 'weakness of the skin' which, though it can hardly be termed a skin disease, demands our attention. Such patients have a tendency to profuse perspiration, and on the least exposure to cold 'catch a chill,' and suffer from muscular rheumatism, neuralgia, diarrhoea, or catarrh of the nasal or bronchial mucous membranes. Sometimes the condition accompanies convalescence from acute disorders, and the remarks which we have made under that heading apply here. Sometimes the cutaneous condition is merely a part of a generally weak constitution. In the latter case high altitudes and cold localities have generally to be avoided, but prolonged residence at some dry inland health resort of moderate elevation may be useful during summer, if much time can be spent in the open air. A certain amount of 'hardening' can be accomplished in many cases by appropriate hydrotherapeutic measures and by open-air exercise. A long sea voyage in warmer climates during winter may be recommended when the patient is a 'good sailor.' See also the section on Bad Circulation in the Extremities in Chapter XXXV.

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INDEX¹

The figures refer to the pages. The main references, when there are several have been distinguished by rather larger and thicker figures.

The names of authors and authorities have been printed in small capitals.

- AACHEN (Aix-la-Chapelle), 187, 356, 367, 368, 425, 533, **541**, 634, 648, 728, 730
Aachen, 'table water' prepared from the Kaiserquelle, 351, 542
Abano, 167, **445**, 577
Abbach, 555
Abbas-Tuman (Caucasus), 232, **398**
Abbazia, **96**, 236
Abbazia, winter temperature, 622
ABDERHALDEN, EMIL, 60, 61, 62, 745
Aber See (St. Wolfgang See), 220
Aberayron (Cardigan Bay), 250
Aberdeen, **254**, 280
Aberdovey (Cardigan Bay), 250
Aberfoyle, 277
Aberystwith, 250
Abetone, Albergo dell' (Apennines), 168
Abortion, habit of, 722
ABRANS, B. A., 408
Abrolis water (Toennistein), 598
Abtenau, Bad, 494
'Acapnia' theory of mountain sickness, 58
Accessory spa-treatment, 356
Acclimatisation to high altitudes, 59, 64
Achensee, The, **218**, 608, 609
Achill, 259
Acidulated waters, simple. See *Table Waters*
Acireale, 91, **578**
Acqua Acetosa (near Rome), 598
Acqua Acidula (near Casciana), 397
'Acqua Madre.' See *Mutterlauge*
Acqua Santa of Chianciano, 495
Acqua Santa (near Rome), 577
Acquarossa, 155, **517**
Acque Albule, 577
Acqui, 337, 338, 367, **575**, 634
Acqui (Italy), 167
Acrocyanosis, 698, 742
ADAMSON, H. G., 743
Adelboden, 149
Adelheidsquelle at Heilbrunn, 213, **433**
Adelholzen, Wildbad, 324, 603
Adelsberg, 223
Adenoid vegetations of the naso-pharynx, 683, 687
Adiposity. See *Obesity*
ADLER, O., 497
Admaston (Shropshire), 421
Admiralsgarten-Bad (Berlin), 434
Adonis water, 598
Adriatic coast, Austrian, 96
Adriatic coast, Venice, 94
Aërated waters, artificial, 596
Aërated waters, natural or artificial, possible injurious effect of their constant use, 597
Aërated waters, natural simple. See *Table waters*
Aesculap water, 488, 494
'After-cure,' hydrotherapy during, 311
'After-cure,' importance of, 355, **368**, 727
'After-cure,' localities after a late cure, 609
'After-cure,' localities for cases of chronic bronchitis and pulmonary emphysema, 609
'After-cure,' localities for chronic rheumatic cases and rheumatoid arthritis, 608
'After-cure,' localities in the British Islands, 609
'After-cure,' localities of considerable elevation, 605, 606
'After-cure,' localities of moderate elevation, 607
'After-cure,' localities for malarial cases, 608
'After-cure,' localities for patients with cardiac affections, 608
'After-cure,' often required in order to ensure a sufficient period of mental rest, 355, 727
'After-cure,' precautions during, 610
'After-cure,' selection of localities for, 605
Aged persons. See *Old age*
AGERON, E., 365, 702, 745
Agi Deka (Corfu), 99
Agnano, Lago d', 472

¹ For a portion of this index the authors are indebted to Miss Weber.

- Agrigentum. See *Girgenti*
 Ahlbeck, 129
 Ahrweiler, 188
 Aibling, 433
 Aigle-les-Bains, 154, 314
 Aigle-les-Bains, water of, 599, 602
 Aiguemont, 604
 Air, atmospheric. See *Atmosphere*
 Air baths and sun baths, 352
 Air baths, compressed air. See *Compressed air baths*
 'Air cure.' See *Open-air treatment*
 Air, expired, injurious properties of, 18
 Air, movements of, 42. See also *Winds* and *Cyclones*
 Air (pure air, fresh air) treatment. See *Open-air treatment*
 Airthrey. See *Bridge-of-Allan*
 Aix 'bouillon,' 544
 Aix in Provence, 173, 390
 'Aix massage.' See *Douche-massage*
 Aix-la-Chapelle. See *Aachen*
 Aix-les-Bains (Aix in Savoy), 171, 357, 368, 390, 543, 648, 730
 Ajaccio, 92, 236
 Akratothermal waters. See *Simple thermal waters*
 Al Hayat sanatorium (Helouan), 104
 Alagna, 166
 Alai (Lebanon mountains), 101
 Aland Islands (Baltic), 132
 Alanje, 595
 Alassio, 86, 291
 Alban Mountains (Italy), 169
 Albano (Alban Mountains), 169
 Albersdorf, 516
 Albertville (France), 172
 Albisbrunn, 159
 Albula route, resorts of the, 145
 Albuminuria, 713
 Albuminuria, cyclic or postural, 713
 Albuminuria, dyspeptic, 471
 Albuminuria, gouty, 490, 547
 Albuminuria in apparently healthy persons, 713
 Albuminuria, 'phosphaturic,' 471, 490
 Albuminuria, temporary and lesser forms of, 471, 713
 Alceda, 579
 Alcoholism, voyages on temperance ships for, 74
 Aldborough, 257
 Aldeburgh, 257
 Alderney Manor sanatorium, 245
 Aldfield Spa Springs (near Ripon), 548
 Aldon, L., 403
 ALESSANDRI, D', 576
 Alet, 392, 599
 Alexandersbad, 203, 314, 512, 607, 609
 Alexandria, 101
 Alexisbad, 200, 509, 523, 607
 Alfredsquelle of Marienbad, 479
 Algeciras, 118
 Algeria, 107
 Algiers, 107, 236, 293
 Algiers, sanatorium near, 108
 Algyogy, 386
 Alhama-de-Aragon, 397
 Alhama-de-Granada, 398
 Alhama-de-Murcia, 595
 Alicante, 117
 Alimentary system, diseases of. See *Digestive system*
 Alkaline baths, 453
 Alkaline-earthly mineral waters. See *Earthy mineral waters, alkaline*
 Alkaline-earthly 'table waters,' 597, 599
 Alkaline mineral waters, muriated. See *Muriated alkaline waters*
 Alkaline mineral waters, simple, 325, 344, 452
 Alkaline mineral waters, simple, external use, 453
 Alkaline mineral waters, simple, internal use, 344, 452
 Alkaline mineral waters, sulphated. See *Sulphated alkaline waters*
 Alkaline (muriated) group of table waters, 597, 598
 Alkaline (simple) group of table waters, 597, 598
 Alland Sanatorium (Wiener Wald), 221
 ALLBUTT, T. C., 745
 ALLEN, H. S., 328, 378
 Allerheiligen (Black Forest), 196
 Allevard, 172, 571, 621
 ALPAGO, R., 322
 Alpenclub Hotel (Maderaner Thal), 149
 Alphenheim at Aussee (hydrotherapy, &c.), 220, 314
 Alsatian resorts, 193
 Alt-Aussee, 220, 435, 607, 609
 Alt-Haide, 206, 516
 Alt-Heide. See *Alt-Haide*
 Alt-Prags, 217, 556
 Alt-Schmecks, 226
 Altadore Sanatorium (Kilpedder), 261
 ALTDORFER, M., 660, 745
 Alten-Salza. See *Ehnen*
 Altenahr, 188
 Altenberg Hotel (Münsterthal), 183, 193, 607, 608
 Altenburg (Lower Austria), 556
 ALTHAUS, J., 745
 Altheikendorf, near Kiel, 128
 Altitude, influence of, on the atmosphere and climate, 16, 28, 37, 38, 55, 57, 64, 65, 134, 262. See also under *Climate, influence of altitude and latitude on*
 Altitude, influence of relatively slight differences in altitude, as exemplified by British climates, 65, 262
 Altitudes, high, &c. See *Climates of high altitude, &c.*
 Altorf (Aldorf), 158
 Altwasser, 206, 517
 Altweier, 193, 607
 Alum Bay (Isle of Wight), 244
 Alum in mineral waters, 323, 326
 'Alum' spring of Aix-les-Bains, 543
 'Alum' well (sulphate of iron) of Harrogate, 546
 Alvanen. See *Alvenen*
 ALVARENGA, 341
 Alvenen, 155, 518, 563
 Amalfi, 90

- Amberley (Minchinhampton Common), 271
- Ambleside, 276
- Ambrosiusbrunnen of Marienbad, 479, 480
- Amélie-les-Bains, 174, 367, **569**, 634
- Amenorrhœa, 719
- American resorts of high altitude, compared, 137
- Amiens, 294
- Amphion-les-Bains, 602
- Amrum, 127
- Amsterdam, 286
- Anæmia, 640. See also *Anæmic conditions*
- Anæmia, connected with hypoplasia of the circulatory system &c., 642
- Anæmia, malarial, 664. See also *Malarial Affections*
- Anæmia, tropical, 663
- Anæmic conditions, 496, 501, **640**
- Anæmic conditions, importance of rest in, 641, 642, 644
- Anæmic conditions, summer resorts for, 645
- Anæmic conditions, various classes of, 643
- Anæmic conditions, winter resorts for, 645, 646
- Analysis of mineral waters, results may be expressed in salts or ions, 319
- Andabre, 461, 531
- Andeer-Pignieu (Switzerland), 155, **518**
- Andermatt, 142, **146**
- Andes, high altitude resorts compared, 137
- Andorno, 166
- Andreasberg. See *St. Andreasberg*
- Aneurysm, 697
- Angers, 294
- Angicourt sanatorium (France), 183
- Angina pectoris. See under *Heart*
- Anglesey, Isle of, 251
- Annecy and Lake of Annecy, 172
- Annweiler, 193, 622
- Antibes, 82
- Anticoli-di-Campagna, Fiuggi spring near, 602
- Anticyclones, 40
- Antignano (Livorno), 88
- Antogast, 196, 418, **511**
- Antwerp, 286
- Aortic aneurysm, 697
- Apenta water, 320, 414, 488, 494
- Apollinaris table water, 321, **598**
- 'Aponi Fons.' See *Abano*
- Appendicitis, remnants of, and convalescence from, 370, 389, 640
- Appenzell, 159, 621
- Appenzell, Canton of, resorts of, 159
- Apennine Allobrogum. See *Aix-les-Bains*
- Aquæ Apollinares. See *Vicarello*
- Aquæ Aponenses. See *Abano*
- Aquæ Augustæ Tarbellicæ. See *Dax*
- Aquæ Aureliæ. See *Baden-Baden*
- Aquæ Calidæ. See *Hamnam R'Irha*
- Aquæ Domitiana. See *Aix-les-Bains*
- Aquæ Gratianæ. See *Aix-les-Bains*
- Aquæ Mattiacæ. See *Wiesbaden*
- Aquæ Patavinæ. See *Abano*
- Aquæ Sextiæ. See *Aix in Provence*
- Aquæ Solis or Aquæ Sulis. See *Bath*
- Aquæ Statiellæ. See *Acqui*
- Aquensis Civitas. See *Aachen*
- Aquianum. See *Erian-les-Bains*
- Aramayona, 579
- Arapatak. See *Eelopatak*
- Arcachon, 121
- Arceux, Source des (Saint Christau), 604
- Archena, 170, **579**
- Arco, 163, **165**, 166, 236, 622
- Ardennes, health resorts of, 183, 184
- Ardenza (Livorno), 88
- Ardrossan, 253
- Archavaleta, 579
- Arenation. See *Sandbaths*
- Arensburg, and mud baths at, 131, 339
- ARETEUS, 668
- Argelès-de-Bigorre. See *Argelès-Gazost*
- Argelès-Gazost, 177, **568**
- Argentière (Chamonix valley) 171, 608
- Argentine Republic, voyage to, 70
- Argon in mineral waters, 324, 348
- Argon in the atmosphere, 17
- Arles, 294
- ARMAND-DEUILLE, 60
- Arminius spring at Lippspringe, 582, 588
- ARMSTRONG, W., 378, 745
- Arnedillo, 448
- Arnstadt, 202, **426**
- Arolla, 147, 608
- Arosa, 140, 607
- Arosa, sanatorium treatment at, 627
- Arran, Isle of, 253
- ARRHENIUS, 319
- Arsenic in mineral waters, 525, 526, 527
- Arsenical waters, 326, 346, **525**
- Arsenical waters, effects of internal use of, 346
- Arsenical-chalybeate waters, 525, **528-531**
- Arteries, atheroma and sclerosis, 696
- Arteries, diseases of. See under *Circulatory system*
- Arteriosclerosis. See under *Circulatory system*
- Artern, 434
- Arthritis deformans. See *Rheumatoid arthritis*
- Arthritis ossificans, progressive, 657
- Arthritis, rheumatoid. See *Rheumatoid arthritis*
- Arthritis, senile. See *Rheumatoid arthritis*
- Arthritis, traumatic. See *Joints, chronic affections of traumatic origin*
- Arthritis, tuberculous. See under *Tuberculosis, articular and osseous*
- Articular affections. See under *Joints*
- Articular rheumatism. See under *Rheumatism*
- Artificial mineral waters. See *Mineral Waters, artificial*
- Artonne, 461
- Aschaffenburg, 294
- ASCHOFF, K., 411
- Asciano, 396

- Ascot, 273
 Ashby-de-la-Zouch, 265, **419**
 Ashdown Forest, 272
 Askern Spa, 268, **548**
 Aspect of a place, influence of on the local climate, 50
 Aspley Guise, 275
 Assmannshausen, 188, **467**, 622
 Assouan (Asswan), 105
 Asthma, 528, 551, **691**
 Asthma associated with pulmonary tuberculosis, 674
 Asthma, 'cardio-vascular,' 692
 Asthma, sanatorium treatment for, 588
 Asthma, sometimes aggravated at the seaside, 55
 Asthma, typical 'paroxysmal neurosis' form of, 691
 Asthma with chronic bronchitis, 692
 Asthma with pulmonary emphysema, 692
 Astringent baths. See *Sulphate of iron baths*
 Astrop, St. Rumbold's Well at, 504
 Athens, 100, **292**
 Atlantic equatorial current, 40
 Atlantic sea-water, composition &c., 449, 451
 Atmosphere. See also *Climate, influence of vegetation on*; *Climate, influence of forests on*; *Climate, influence of neighbouring mountains on*; *Climate, influence of drainage of the soil on*, &c.
 Atmosphere, barometric pressure. See *Atmospheric pressure*
 Atmosphere, composition of, 17
 Atmosphere, 'condensation-nuclei,' 34
 Atmosphere, dew-point, 33
 Atmosphere, dust in, 19. See also under *Dust*
 Atmosphere, electrical phenomena, 31
 Atmosphere, greater purity at high altitudes, 57
 Atmosphere, humidity. See *Humidity, atmospheric*
 Atmosphere, influence of light and sunshine. See *Light and Sunshine*
 Atmosphere, iodine in sea-air, 449, 732
 Atmosphere, micro-organisms in, 18, 19
 Atmosphere, moisture. See *Humidity, atmospheric*
 Atmosphere, movements in, 42. See also *Winds and Cyclones*
 Atmosphere of high altitudes, 55. See also *Climates of high altitude*
 Atmosphere, precipitation, 34
 Atmosphere, radio-activity, 32, 57, 322, 328
 Atmosphere, temperature of. See *Temperature, atmospheric*
 Atmosphere, the influence of altitude on. See under *Altitude*
 Atmospheric air. See *Atmosphere*
 Atmospheric pressure, 38
 Atmospheric pressure, diminished, physiological and pathological effects, 41. See also under *Climatotherapy, climates of high altitude*
 Atmospheric pressure, effects in man, 41, 61
 Atmospheric pressure, effects on the blood, 61
 Atmospheric pressure, increased, effects of, 41; 'compressed-air baths,' 41, 432, 465, 689
 Attersee, 220
 Aubrac sanatorium (France), 180
 Auchterhouse (Sidlaw Hills), 278
 Aud'hout, V., 756
 Audinac, 592
 AUBURERT, 740
 Auerbach, **193**, 510
 Augsburg, 294
 Augustusbad, 204, **513**
 Aulus, 592
 Aural conditions in regard to climates, sea-bathing, and spa treatment, 739
 Aural vertigo and Manière's symptoms, 739
 Aussee, **220**, 435, 607
 Australia, voyages to, 71
 Austria, inland health resorts, 214, 219
 Austrian Adriatic coast, 96
 Auteuil (Paris), 183, 314, 524
 Auvergne Mountains, health resorts of, 178
 Avants, Les, **142**, 152, 545, 608, 692
 Avène, 392
 Aviemore, 278
 Avignon, 294
 Avila (Spain), 170
 Avranches, 122
 Ax-les-Thermes, 175, **568**
 Axalp (above Giessbach), 149
 Axbridge, 270
 Axenfels (Switzerland), **158**, 608
 Axenstein (Switzerland), **158**, 608
 Azores islands, 116
 BAASEN, 436
 Babbacombe (near Torquay), 246
 Backache, 730. See also *Lumbago*
 Bad-Boll. See *Boll, Bad*
 Bad-Driburg. See *Driburg*
 Bad-Elster. See *Elster, Bad*
 Bad-Fideris. See *Fideris*
 Bad-Friesel. See *Pousseé thermale*
 Bad-Gastein. See *Gastein*
 Bad-Heutrich. See *Heutrich*
 Bad-Rehburg. See *Rehburg, Bad*
 Baden-Baden, 194, 296, 357, 358, 367, 368, 398, 417, 526, 609, 614, 625, 634, 730
 Baden-Baden, radio-activity of its springs, 322, 329
 Baden in Switzerland, 160, **558**, 582, 730
 Baden (near Vienna), in Austria, 221, 322, **556**
 Badenweiler, **196**, **380**, 607, 608, 609
 Badersee (Bavarian Alps), 213
 Badoit, Source, at St. Galmier, 321, 599
 BAEUMLER, C., 745
 BAGARD, 586
 Bagnères-de-Bigorre, 176, 394, 520, 567, 582, **590**
 Bagnères-de-Luchon. See *Luchon*
 Bagni Caldi (Bagni di Lucca), 168, 582, **594**

- Bagni di Lucca. See *Lucca, Bagni di*
 Bagni di Nerone. See *Nerone, Bagni di*
 Bagni di Pisa. See *San Giuliano*
 Bagni San Giuliano. See *San Giuliano*
 Bagnigge Wells, 504
 Bagno-in-Romagna, 169, **461**
 Bagnoles-de-l'Orne, 183, 321, **394**, 698
 Bagnoli, near Naples, 472
 Bagnols-les-Bains, 180, **572**
 Bagshot, 273
 Bahia, voyage to, 70
 BAILY, E., 254
 BAIN, W., 10, 320, 347, 348, 535, 546, 547, 652, 653, 745
 Bains-de-la-Reine, near Oran, 109
 Bains-les-Bains, **182**, **390**
 Baireuth. See *Bayreuth*
 Bakewell, 264, **379**
 Bala (Wales), 277
 Balaruc, 444
 Balaton-Füred (Hungary). See *Füred*
 Balaton Lake (Platteusee) and its mineralised water, 229, 601
 BALBI, V., 86, 89, 92, 95, 289, 291
 Baldoez, 517
 BALDWIN, F. R., 669
 BALDWIN, W. W., 745
 Bâle. See *Basel*
 Balearic Islands, 94
 Balligues (Swiss Jura), 160
 Ballater, 278
 Ballenstedt, 200, 607
 Balloon ascents, changes in the blood during, 62
 Ballybunnion, 259
 Ballynahinch (Connemara), 279
 Ballynahinch (Co. Down), 279, **553**
 Ballyspellan (Kilkenny), 504
 'Balnearia.' See *Bagnères de Bigorre*, and *Luchon, Bagnères de*
 'Balnearia Lixonsensis.' See *Luchon, Bagnères de*
 Balneology, origin of the word, 299
 'Balneolum.' See *Bagnoli, near Naples*
 Balneotherapy. See *Spa-treatment*
 Balneotherapy and Balneotherapeutics, definition, 299
 Balta-Alba (Roumania), 230
 Baltic health resorts, 127, 130
 Baltic health resorts, brine springs at, 131
 Baltic health resorts, sanatoria for children, 131
 Baltic sea-water, temperature and composition of, 130, 449, 451
 BALTOUZEWSKI, 400, 745
 Baltrum, 126
 Bamberg, 294
 Banachory Sanatorium (Nordrach-on-Dee), 278
 Bangor (Co. Down), 260
 Bangor (Wales), 251
 Banky (Bulgaria), 231
 BANNATYNE, G. A., 745
 Banstead and Banstead Downs, 273, 274
 Bantry Bay (Ireland), 259
 Banyuls-sur-Mer, 117
 BAQUE, 740
 BARADUC, A., 470, 706, 746
 Barbadoes, voyage to, 70
 Barbazan, 593
 Barbotan, **520**, 574
 Barcelona, 117
 BARDET, G., 328
 BARDSWELL, N. O., 629
 Barèges, 176, 533, **566**
 Barègine in thermal waters, 323, 326
 'Barisart' spring near Spa, 499
 Barium chloride, effects of, 347, 401, 547
 Barium chloride in mineral waters, 347, 401, 421, 535, 547
 'Barium water' of Ilkangummarh Wells, 421
 Barlangliget. See *Tatra-Barlangliget*
 Barmouth, 250
 BARNARD, H., 362
 BARNES, R., 773
 Barnet, 284
 Barnet Wells, 489
 BARRIÉ, 740
 Bartha (Bartfeld), 227, **515**
 Bartfeld (Hungary). See *Bartha*
 BARUCH, S., 300, 746
 Barzun spring, near Barèges, 176, **566**, 567
 Basedow's disease. See *Graves's disease*
 Basel (Bâle), **180**, 287
 Baslow 'hydropathic,' 265
 Bath (England), 263, 280 (meteorological means), 295, 367, 368, **376**, 526, 582, 588, 599, 634, 730
 Baths. See *Heat baths, Mud baths, Sand baths, Gas baths, Electric baths, Hot-air baths, Vapour baths, Electric-light and radiant-heat baths, Sea bathing, Sea-water baths, Sun baths, &c.*
 Baths, absorption from, 332
 Baths, absorption from, influenced by electrolytic methods, 'ions of chlorine' &c. made to penetrate through the skin, 304, 332, 658
 Baths, absorption of gases from, 333
 Baths and douches of plain water, hot air, and hot vapour, 303, 304. See also *Hydrotherapy*
 Baths, aromatic, 315
 Baths, cold, 308, 311
 Baths, 'compressed air baths,' 41, 432, 465, 689
 Baths, hot, 309, 310
 Baths, 'iodine baths,' 315
 Baths, 'medicated,' absorption from, influenced by electrolytic methods, 304
 Baths, 'medicated,' and baths of 'medicated' mineral waters, 300, 315, 334, **351**, 547, 695
 Baths of carbonic acid gas. See *Gas (carbonic acid) baths and douches*
 Baths of mineral waters, 331. See also *Simple thermal water baths, Brine baths, Alkaline water baths, Sulphur water baths, Gaseous (effervescent) baths, Thermal Soolbaeder, Nauheim baths, Gastein (radio-active) baths, Loeche prolonged tepid baths, Plombières treatment, &c.*

- Baths of mineral waters, action of, influenced by electrolytic methods, 304
 Baths of mineral waters (artificial), 300 315, 334, **351**, 547, 695
 Baths of mineral waters, effect of gases in, 333, 334
 Baths of mineral waters, general conclusions on action of, **334**, 335
 Baths of mineral waters, influence on the osmotic pressure of the blood, 333
 Baths, 'ozone baths,' 315
 Baths, 'pine baths,' 315
 Baths, 'poussée thermale' from. See under *Poussée thermale*
 Baths, prolonged tepid, as at Loèche-les-Bains, 371, **387**, 583, 591, 742; action on chronic skin affections, 371, 387, 742; 'poussée thermale' from, 387, 742
 Baths, 'Sprudel' and 'Sprudelstrom' baths of Nauheim, 406
 Baths, temperature of, 305
 Baths, tepid, 312, 331, 332, 371. See also *Baths, prolonged tepid*
 Battaglia, 167, 336, 337, 339, **395**, 577
 Bauche, La, 172, **521**
 Baule, La, 122
 BAUMANN, E., 732
 BAUMANN, F., 380, 746
 BAUMSTARK, R., 746
 BAUR, F., 746
 Bavaria, Rhenish Palatinate, resorts of, 192
 Bavarian Highlands, resorts of the, 211, 212, 213
 Baveno, 161
 Bayna, Fontaine (Salies-de-Béarn), 444
 BAYARD, F. C., 10, 239, 242, 244, 246, 247, 249, 256, 257, 264, 269, 746
 Bayard spring (Larivière-sous-Aigremont), near Bourbon-Lancy, 442
 Bayreuth, 295
 BAZIN, E., 746
 Beachy Head, 241
 Beatenberg. See *St. Beatenberg*
 Beaucens, 574
 Beaulieu (French Riviera), 83
 Beaumais, 251
 Beckenried (Lake of Lucern), 157
 Beddgelert, 276
 Beer (Devonshire), 246
 BREERWALD, K., 529
 BEEVOR, Sir HUGH, 282, 684
 BEGGIE, W., 347
 BEHSE, 339
 BEISSSEL, J., 746, 773
 Belalp Hotel (Switzerland), 143, **147**, 607, 608
 Belchen (Black Forest), the, 198
 Belgium, coast of, 125
 Belgium, inland health resorts of, 183
 Bella Tola Hotel (near St. Luc), 147
 Bellagio, **163**, 609
 Bellevue Hotel (Little Scheidegg), 149
 Bellevue, Pavillon de (Mendon, near Paris), 287
 Bellevue Sanatorium (Shotley Bridge), 276
 Bellthal, 599
 BELUDOU, M. A., 746
 Belvédère Hotel, at Lanzo d'Intelvi, 163
 Belvédère Hotel, close to the Rhone Glacier, 146, 608
 Ben Rhydding, 276, 314
 Bendorf (hydrotherapy), 188, 314
 BENEKE, F. W., 54, 405, 407, 746
 BENNETT, JAMES HENRY, 79, 84, 746
 BENNETT, A. G., 746
 BENNETT, JOHN HUGHES, 626, 746
 BENSAUDE, R., 62
 BENSON, 317
 Bentheim, Bad, 209, **555**
 Bentley Priory, 274
 Berchtesgaden **212**, **431**, 607
 Berck-sur-Mer, 124
 Berck-sur-Mer, sanatoria for 'children at, 630
 Berg, near Stuttgart, 430
 Berg-Dievenow, 129
 Berg-en-Dal, near Nijmegen, 187
 Berg-und-Thal, near Cleve, 187
 BERGELL, P., 329, 341, 417, 599, 703, 704, 746
 BERGER, M. S. D., 230, 746
 BERGONIGNAN, P., 602, 747
 Bergstrasse (Odenwald), resorts of the, 193
 Berguen, 141, 145, 503, **590**
 Berisal, 147
 Berka, 202, **509**
 Berlin, 286, 293 (meteorological means), 434
 Bermondsey Spa, 504
 Bern, **156**, 287
 BERNARD, F., 329, 372, 388, 747
 Bernburg, 434
 Berneck, **203**, 607
 Bernese Oberland, high altitude resorts of, 148
 BERNHARD, O., 28, 57, 747
 Bernina Hospice Hotel, 145
 BERT, PAUL, 41, 58, 60, 747
 Berthe 'box' vapour baths, 305
 Berthement, 574
 Berthollet local vapour baths, 305, 544
 BERTIER, L., 747
 Bertrich, Bad, 189, **486**
 Besançon and the baths of La Mouillère, 181, 294, **442**
 Besaya, Caldas de. See *Caldas-de-Besaya*
 Bettws-y-Coed, **277**, 280
 Beulah Spa (hydrotherapy) 314
 Beuzeval, 124
 Bex, 154, **438**, 622
 Bexhill, 241
 Beyrout, 101
 BIANCELLO, 594
 Biarritz, **120**, 541
 Biarritz, Briscous brine baths at, 121, **444**
 Bibliography (climatotherapy, balneo-therapy and hydrotherapy), 745
 Bibliography relating to the methods and results of the sanatorium treatment of pulmonary tuberculosis, 628, 629

- Bibra, 508
 Bicarbonate of sodium in mineral waters, 325, 344, 452, 463
 Bicarbonates of sodium and calcium ('mixed bicarbonates') in mineral waters, 327
 BICKEL, A., 329, 341, 342, 344, 401, 402, 417, 452, 463, 474, 488, 596, 599, 702, 703, 746, 747
 BIER, A., 680
 Bile ducts, affections of, 707
 Biliary affections. See *Bile ducts*.
 Biliary colic during spa-treatment, 710
 Biliary concretions. See *Cholelithiasis*
 Bilin, 225, 459, 598
 'Biliousness' and functional disorders of the liver, 708
 'Biliousness' and intestinal auto-intoxication, 733
 'Biliousness' induced by sea-air, 55, 76, 616, 651, 708
 BILLARD, 527
 BILLWILLER, R., 42, 45, 138, 140, 150, 151, 161
 Bingen, 187
 Binn (Switzerland), 147
 BINZ, C., 497
 Binz (Island of Ruegen), 129
 Bron, W., 159
 Birchington, 239
 Birmenstorf bitter water, 320, 489, 495, 559
 Birresborn, 189, 458, 598, 600
 Bishops-Teignton, 247
 Biskirchen, 'Karlsprudel' at, 598
 Biskra (Algeria), 110
 Bitter waters, 320, 326, 342, 488
 Bitter waters, Birmenstorf. See *Birmenstorf*
 Bitter waters, Bohemian. See *Puella, Sedlitz, and Saidschitz*
 Bitter waters, Caucasus (Karras) bitter water, 494, 580
 Bitter waters, 'Cheltenham natural aperient water,' 493
 Bitter waters, doses of, 495
 Bitter waters, 'Hessisches Bitterwasser,' 425
 Bitter waters, Hungarian, 488
 Bitter waters, 'Kissingen Bitterwasser,' 415
 Bitter waters, table of analyses, 494, 495
 Bituminous material in springs. See *Naphtha and bituminous material in springs*
 BLACK, J. G., 747
 Black Forest, resorts of the, 194
 Black Forest springs, radio-activity of, compared, 417, 418
 Black Sea Coast, brine lakes or 'limans,' 100, 337
 Black Sea, composition of water of, 449
 Black Sea resorts, mud baths at, 100, 337
 Blackdown Hill (near Haslemere), 273
 Blackpool, 252, 280
 Bladder, diseases of the. See *Urinary bladder*
 Blair-Atholl, 278
 BLANC, G. A., 322, 329, 340, 747
 BLANC, L., 334, 747
 Blanche, Source, at Luchon, 537
 Blankenberghe, 125
 Blankenburg (Harz Mountains), 200, 607
 Blankenburg (Thuringia), 201
 Blarney, 258
 Blauen, the, 197
 Blida (Algeria), 108
 Bligny sanatorium (France), 183
 Bloemendaal (near Haarlem), 126
 Blois, 294
 Blood, changes in at high altitudes, 58, 60, 62
 Blood, changes in during balloon ascents, 62
 Blood, changes resulting from general massage and muscular exercise, 308, 660
 Blood, changes resulting from hydrotherapeutic methods, 308, 660
 Blood, chronic excess of carbonic acid, in regard to gouty conditions and disorders of metabolism, 653
 Blood, condition of, in chlorosis and various anemias, 641
 Blood, effect of the internal use of chalybeate waters on the, 345, 346, 496, 497
 Blood, effect of the internal use of sulphur waters on the, 534, 535, 547
 Blood, osmotic pressure of, effects of the internal use of mineral waters on, 342
 Blood, osmotic pressure of, in regard to mineral waters and baths, 320, 321, 333, 342
 Blood, osmotic pressure of, influence of brine and other baths on, 333
 Blood, true plethora of, 698
 Blood vessels, degenerative changes in, 696. See also under *Circulatory system and Heart and circulatory system*
 BLYTHWOOD, LORD, 328, 378
 Boars Hill (near Oxford), 274, 295
 Bocca d'Arno, 88
 Bocca, La (near Cannes), 82
 Bocklet, 211, 414, 513
 Bodenbach, 204
 BODINGTON, GEORGE, 626, 747
 Bognanco (Domodossola), 166
 Bognor, 242
 Bohemia, health resorts of, 223
 Boils. See *Furunculosis*
 Boll, Bad (Baden), 198, 556
 Boll, Bad (Württemberg), 555
 'Bollente' spring at Acqui, 575
 Bologna, 291
 Bonchurch (Isle of Wight), 244
 Bondonneau, 599
 Bonifacius spring of Salzschlirf, 320, 424
 Bonifacius spring of Tarasp, 484
 Bonn, 187, 294, 295, 296
 Bonnes. See *Eaux Bonnes*
 BONNET, SAINT-R., 747
 Boppard, 188
 Borates in mineral waters, 323, 559
 Borea (Tirol), 217

- Borcette. See *Burtscheid*
 Bordeaux (hydrotherapy), 314
 BORDET, G., 747
 'Bordeu' spring of Luchon, 537
 BORDIER, H., 536
 Bordighera, 85
 Borghetto (Bordighera), 85
 BORGMAN, J. J., 330
 Borjom (Caucasus), 232, **462**
 Borkum, 126
 Bormio, 166, **394**, 608
 Borszek, 227, **516**
 Boscastle, 249
 Boscombe (Bournemouth), 245
 BOSIA, H. DE, 441, 747
 Bosnia, 229
 Bossington, 249
 Boston Spa (Thorp Arch), 421
 BOTTENTUIT, E., 389, 706, 747
 BOTTEY, F., 747
 Bottled mineral waters, changes occurring in after bottling, and methods of bottling, 350, 497, 536
 Botzen, **215**, 609, 622
 BOUCHARD, C., 748
 'Bouillon' vapour baths at Aix-les-Bains, 544
 Boulogne, 125
 Boulou, Le, 175, **460**
 Bourbon-Lancy, 181, 329, 398, **440**
 Bourbon-l'Archambault, 181, **439**, 724
 Bourbonne-les-Bains, 182, 357, **441**, 730
 Bourboule, La, 179, 321, 471, **526**, 688, 721, 743
 BOURCET, 732
 Bourget, Lac du, 171, 545
 Bourguement Sanatorium (Belgium), 184
 Bournemouth, 236, **244**, 629
 Bousk. See *Busk*
 BOUSQUET, 451
 BOWDITCH, 47
 Bowels, disorders of. See *Intestines*
 BOWLES, R. L., 28, 748
 Bowness, 276
 Box Hill, 273
 BOYCOTT, A. E., 58
 BRABAZON, A. B., 748
 BRACHET, 748
 Brachialgia, 372, 729
 Bradycardia, permanent, 695
 Bradycardia, temporary, after influenza, &c., 694
 Braemar, **278**, 280
 Bragoun (Caucasus), 323, 580
 Braid Hills (Edinburgh), 284, 295
 Brain, chronic results of cerebral hæmorrhage and thrombosis, 724
 Brain, organic affections of, **724**, 728
 'Brain-fag.' See *Mental overwork*
 BRANDIS, K. J. B., 773
 BRANDT, G. H., 748
 BRANDT, J. E., 88, 576, 748
 Branksome (Bournemouth), 245
 BRAUN, J., 10, 423, 748
 Braunlage (Harz Mountains), 199
 Braunschweig. See *Brunswick*
 BRAUNSTEIN, A., 341, 704
 Braunwald sanatorium (Switzerland), 158
 Bray, 261
 Bray Head, 261
 Brazil, voyage to, 70
 'Break-down,' nervous. See *Mental overwork*
 Bredig's fluids, in regard to possible action of mineral waters, 328
 Regenz, 159
 BREHMER, H., 191, 205, 627, 679, 748
 Bremen, 294
 Bremer Heilstätte, the, at Rehburg, 209
 Brenner Pass, resorts on the, 217
 Brenner Post, 217
 Brennerbad, 217, 218, **385**, 607
 Breslau, 286
 Brest, 122
 Brestenberg (hydrotherapy), 160, 314
 Briançon, 173
 Brides-les-Bains, 172, 321, **490**, 495
 Brides-Salins, 490. See also *Brides-les-Bains* and *Salins-Moutiers*
 BRIDGE, N., 669
 Bridge-of-Allan, 277, **422**
 Bridge-of-Earn, 278, **422**
 Bridge-of-Weir, Ranfurly Hotel, 253
 Bridge-of-Weir, sanatorium, 253
 Bridlington Quay, 256
 Brieg (Switzerland), 155
 Brienz, 156
 Brienz, Lake of, 156, 157
 Bright's disease. See *Nephritis*
 Brighton, **242**, 280 (meteorological means), 504
 Brighton, the German Spa for artificial mineral waters started by Struve, 351
 Brine baths ('Soolbaeder'), 325, **399**, **400**, 437, 682
 Brine baths, artificial, 351
 Brine baths for scrofulous children, 682, 683
 Brine baths, gaseous warm. See *Thermal-Soolbaeder*
 Brine baths, influence on the osmotic pressure of the blood, 333
 Brine lakes ('limans') of Russia, 100, **337**
 Brine-mud baths. See *Mud baths, salt*
 Brines. See under *Muriated waters* and *Brine baths*
 Brique. See *Brieg*
 Briscous brine baths (Biarritz), 444
 Bristol, 294
 Bristol Channel, resorts on the, 249
 British Islands, characteristics of the more elevated resorts, 261, 262
 British Islands, climatic characteristics, 233
 British Islands, inland health resorts, 261
 British Islands, 'local climates' in, 237
 British Islands, seaside resorts of, 236
 British Islands, table of meteorological means for various health resorts, 280
 British Islands, winter resorts, 237
 Brittany, coast of, 122
 Brixlegg, 218
 BROADBENT, J. F. H., 409, 694, 748
 BROADBENT, Sir W., 409, 694, 748

- Broadlands sanatorium (Medstead), 274
 Broadstairs, 239
 Brocken (Harz), the, 199, **200**
 Brockenhurst (New Forest), 271
 Bromides in mineral waters, 346, 401
 Bronchiectasis, 689
 Bronchitis, chronic, 432, 464, 609, **688**, 692
 Bronchitis, chronic, localities for an after-cure to spa treatment, 609
 Bronchitis, chronic, with asthma, 692
 Bronchitis in gouty persons, 464
 Brookshank, H. L., 773
 Brotterode (Thuringia), 201
 Broughty Ferry (Dundee), 254
 'Brow-ague,' 730
 BROWN, LAWRENCE, 628, 685
 BROWN-SAMLER, 112, 113, 114, 115
 BROWN-SÉQUARD, 18
 BROWNRIGG, 351
 BRUCE, J. MITCHELL, 244, 245, 619, 773
 BRUCE, W., 551, 748
 Brucourt, 522
 Brueckenau, 211, **512**, 589, 609
 BRUEGELMANN, W., 691
 Bruenig, Kurhaus, 157
 Bruges, 294
 Brumena (Lebanon mountains), 101
 Brunate (above Como), 163
 Bruneck (Eustertal), 217, 608
 Brunnen (Lake of Lucern), 157, 609
 BRUNNER, A., 748
 Brunswick, 294
 BRUNTON, Sir T. LAUDER, 341, 345, 347, 359, 361, 597, 705, 710, 716, 734, 748
 Brussels, 286
 'Bubenquelle' of Ems, 465
 BUCH, MAX, 403
 BUCHAN, A., 10, 22, 48, 54, 130, 234, 237, 254, 749
 BUCHAN, A. P., 451
 BUCHANAN, Sir G., 47
 BUCKLEY, C. W., 32, 33, 749
 BUCKMASTER, G. A., 61, 62, 748
 Buda-Pest, **228**, 286, 287, 385, 558
 Bude, 249
 Budleigh Salterton, 247
 Buenos Ayres, voyage to, 70
 Buergeln, Schloss (near Badenweiler), 197
 Buergenstock Hotel, 158, 608
 BUERKER, K., 60
 Buesum (Holstein), 127
 'Buettquelle' of Baden-Baden, 417
 Bughea (Roumania), 230
 BUHRER, C., 150
 Builth Wells, 267, 421, **550**
 Bukowine, 516
 Bulgaria, health resorts of, 230
 Buncrana, 260
 Bundoran, 260
 BUNSEN, 57, 323
 BUNZEL, E., 749
 Burford Bridge, 272
 Burgberg (Harz Mountains), the, 199, 428
 Burgbernheim, Wildbad, 324, 373
 Burgess Hill, 274
 Burghas (Bulgaria), 231
 BURTON-FANNING, F. W., 674, 749
 Burtscheid (Aachen), 187, **543**
 Bushey (hydrotherapy), 274, 314
 Busk (Busko, Bousk), 232, 580
 Bussacco (Bussaco), 170
 Bussang, 182, 522, **530**, 598
 BUXBAUM, B., 301, 749, 769, 773, 774
 Buxton, 264, **377**, 503
 Buzias, 515
 CABOURD-DIVES, 124
 Cachat, Source, at *Evian-les-Bains*, 602
 Cachectic conditions from long residence in hot climates. See *Anemia, tropical*
 Cachexia. See *Anemia, Syphilitic cachexia*, &c.
 Caciulata, 230
 Cadéac, 524, **567**
 Cadenabbia, **163**. 236 (winter temperature), 609
 Cadiz, 119
 Cæsium in mineral waters, 323
 CAFFERATA, 500
 Caille, La, 574
 Cairo, **102**, 236, 293
 Caisson disenso, 41
 Caister-on-Sea, 257
 Calais, 125
 Calcareous mineral waters. See *Earthy mineral waters*
 Calcareous salts in mineral waters, comparative table, 582
 Calcium carbonate (bicarbonate) in mineral waters, action of, 348, 401, 582, 653, 715, 720, 735, 743
 Calcium carbonate (bicarbonate) in mineral waters, comparative table, 582
 Calcium carbonate (bicarbonate) waters, 327. See also *Earthy mineral waters, alkaline*
 Calcium chloride in mineral waters, effects of, 347
 Calcium salts, harmful effect of 'hard' drinking water in some persons, 699
 Calcium salts in mineral waters and their effects, 327, **347**, **348**, 401, **582**, 597, 599, 653, 715, 720, 735, 743
 Calcium salts, possible influence of alkaline-earthly mineral waters on the metabolism, 715
 Calcium salts, possible use in regard to menorrhagia, 720
 Calcium salts, use in chilblains, 743
 Calcium salts, use in some chronic headaches, 348, 401, 583, **735**
 Calcium salts, use in urticaria, 743
 Calcium sulphate (gypsum) waters, 327, 348, 582. See also *Earthy mineral waters*
 Calcium sulphate in mineral waters, comparative table, 582
 Calcium sulphide in mineral waters, 326
 Calculi. See *Cholelithiasis* and *Urinary calculi*
 Caldas-de-Besaya, 448
 Caldas-de-Cuntis, 579
 Caldas-de-Gerez, 170, **398**

- Caldas-de-Malavella, 170, **397**
 Caldas-de-Montbuy, 170, **448**
 Caldas-de-Oviedo, 170, **397**
 Caldas-de-Rainha (Portugal), 170, **579**
 Caldas-de-Reyes, 579
 Caldas-de-Tuy, 579
 Caldas-de-Vizella (Portugal), 170, 580
 Callander, 277
 Camaldoli (Upper Arno Valley), 169
 Camberley, Brompton Hospital Sanatorium, near, 273, 629
 Cambo, 178, 565
 Cambridge, 294, 295
 Cambrunnen water, 598
 Camuin, 129, 131, 434
 CAMP, O. DE LA, 628
 Campagne-sur-Aude, 392
 CAMPBELL, HARRY, 689, 749
 CAMPBELL, W. A., 60, 61
 Campher, 144, 502
 Campiglio, 217
 Campu-Lungu, 230
 Canary Islands, 113
 Canary Islands, voyage to, 69
 Canaveilles (Olette), 570
 Canigou sanatorium. See *Mont-Canigou sanatorium*
 Cannes, 81, 236
 Cannet, near Cannes, 82
 CANNEY, H. E. LEIGH, 45, 49, 67, 101, 102, 105, 106, 749
 Canstatt (Cannstatt), 430
 Canterbury, 294, 295
 Cap Martin, near Mentone, 84
 Cape Colony, voyage to, 70
 Capel-Curig, 276
 Capitals and large towns of Europe, 281
 Capitals and large towns, climates &c. of.
 See under *Towns, large*
 Capitals and large towns, tables of meteorological means, 293
 Capri, 91
 Capvern, 592
 Carabacel (Nice), 83
 Carabana water, 321, 489, 495
 Carballino, 170, 579
 Carballo, 170, 579
 Carbon dioxide. See *Carbonic acid*
 Carbonates (bicarbonates) in mineral waters. See *Bicarbonates*
 Carbonic acid baths and douches. See *Gas (carbonic acid) baths and douches*
 Carbonic acid gas in artificially aerated waters, 351, 596, 597
 Carbonic acid gas in baths and its effects. See *Gaseous (effervescent) baths*
 Carbonic acid gas in mineral waters, 323, 333, 343, 452, 596, 597
 Carbonic acid gas in mineral waters, effects in external use, 333
 Carbonic acid gas in mineral waters, effects in internal use, 343, 596, 597
 Carbonic acid gas in mineral waters, possible injurious effects of the constant use of natural or artificial gaseous waters, 597, 653
 Carbonic acid gas in the atmosphere, 17
 Carbonic acid gas, sometimes added to natural mineral waters to make them 'keep well' or improve their taste, 350, 351, 597
 Carbonic acid in the blood, chronic excess of, in regard to theories of gouty conditions, 653
 Carbonic acid in the blood, Mosso's views in regard to the effects of high altitudes, 58
 Carbonyl sulphide gas in mineral waters, 324
 Carburetted hydrogen. See *Marsh gas*
 Carcanières, 574
 Cardiac diseases, &c. See under *Heart*
 Cardigan Bay, resorts on, 250
 Cardio-vascular diseases. See under *Circulatory system and Heart*
 Carinthia, resorts of, 223
 Carlsbad. See *Karlsbad*
 Karlsruhe. See *Karlsruhe*
 Carnarvon, 251, 294
 Carnarvon, King Arthur's Spring near, 504
 Carniola, resorts of, 223
 Carola spring of Rappoltswiler, 588
 Carpathian Mountains, health resorts of the, 226
 Carratraca, 170, **579**
 Carrbridge (Scotland), 278
 CARRON DE LA CAHRIÈRE, G., 749
 CARTELLIERI, P., 482
 Carthagen (Spain), 118
 Casamicciola (Ischia), 472
 Cascaes (near Lisbon), 119
 CASCIANA, 321, 396
 CASPARI, W., 58, 60, 773
 Cassel, 294, 295, 296
 CASSIODORUS, 668
 Castagnola (Lugano), 162
 Castel Gandolfo, 169
 Castel Vieil chalybeate spring, near Luchon, 538
 Castellammare-di-Stabia, **89**, 447, **472**, 668
 'Castelli Romani,' 169
 Castéra-Verduzan, 574
 Castiglione (Ischia), 472
 Castleconnell (Limerick), 279, 504
 Castleton of Braemar. See *Braemar*
 Castro Caro, 168, **447**
 Catania, **91**, 92
 CATON, R., 613, 654
 Caucasus 'bitter water' (Karras), 494, 580
 Caucasus, health resorts of the, 231
 Cauterets, 170, 321, 349, 536, **538**, 621, 688
 Cauvalat-le-Vigan, 574
 Caux, above Montreux, **152**, 545, 607, 608
 Cava dei Tirreni, La, 90
 CAZAUX, M., 749
 Celerina, 144
 'Célestines' springs at Vichy, 453, 454
 CELSUS, 668
 Cerebral affections. See under *Brain*
 Ceresole Reale, 167, 522, **529**
 Cernobbio, 163
 Certosa-di-Val-Pesio, 167

- 'César' spring at Mont-Dore, 527
 'César' spring at Royat, 465, 466, 467
 'César' spring at Saint-Alban, 600
 'César' spring (Renine water). See *Reipertsweiler*
 'César' springs at Cauterets, 538
 Cestona-Guessalaga, 170, **448**
 Cevennes Mountains, health resorts of, 180
 CHABANNE, 749
 Chagford, 269
 Chagford sanatorium, 269
 Chalk in mineral waters. See under *Calcium carbonate*
 Challes, 172, 321, 543, **572**, 688
 Chalybeate waters, 326, **496**
 Chalybeate waters, arsenical, 525, **528-531**
 Chalybeate waters, bicarbonate of iron waters, 498
 Chalybeate waters, changes occurring after bottling, 497
 Chalybeate waters, contra-indications, 496
 Chalybeate waters, external use, 333, 497.
 See also *Sulphate of iron baths* and *Gaseous effervescent baths*
 Chalybeate waters, internal use, 345, 496
 Chalybeate waters, sulphate of iron waters, 503, 504, 523
 Chalybeate waters, thermal, **497**, 520
 Chamonix, 171, 608
 Champel-sur-Arve (Geneva), 153, 314
 Champéry, 154
 Champex, Lac de (Switzerland), 147
 Champrosay sanatorium (France), 183
 Chandolin (Switzerland), **147**, 607
 Channel Islands, the, 123
 CHAPLIN, ARNOLD, 690
 Charbonnières, 521
 CHARCOT, J. M., 520
 Charlottenbrunn, 207, 516
 Charmouth, 246
 Charnex, 151
 Château-d'Ardenne, 184
 Château-d'Oex, 142, **148**
 Château-Gontier, 522
 Châteauneuf (Puy-de-Dôme), 179, 392, **460**, 521
 Châtel-Guyon, 179, 321, 341, 400, 439, **469**, 488, 706
 Châteldon, 181, 599, 600
 Châtenois (Alsace). See *Kestenholz*
 Chaudes-Aigues, 180, **392**
 Chaudfontaine, 184, **379**
 Chaumont, above Neuchâtel, 150
 Cheddar, 270
 Cheltenham, 269, 295, **492**, 495, 503
 'Cheltenham Natural Aperient Water,' 350, 493
 'Chemical' (ultra-violet) rays from the sun, increased at high altitudes, 28, 57
 'Chemical' (ultra-violet) rays from the sun, effects of, 28, 57, 742
 Chenies, 274
 Cherbourg, 124
 Charnex (Switzerland). See *Charnex*
 Cherry Rock, 489
 Chesères, **147**, 154
 Chester, 294
 CHÉAIS, 36, 602
 Chianciano, 169, **594**
 Chiavari, 88
 Chichester, 294
 Chiclana, 579
 Chilblains, special liability to, 698, 742, 744
 Children, open-air schools for, 630
 Children, rachitic and weakly, 647
 Children, sanatoriums, convalescent homes, and rural colonies for, 630
 Children, scrofulous, **681-683**, 685
 Children, scrofulous, diet in regard to, 685
 Children, scrofulous, sea-air and brine baths for, 682, 683
 Children with adenoid vegetations of the naso-pharynx, 683
 Children with tendency to pulmonary tuberculosis, 682
 Chiltern Hills, 274
 China, voyages to, 70
 Chingford, 274
 CHIPPINGDALE, S. D., 274
 Chislehurst, 272, 284, 295
 Chloride (chloride-containing) waters. See *Muriated waters*
 Chloride of barium. See *Barium chloride*
 Chloride of calcium. See *Calcium chloride*
 'Chloride of Iron Well' at Harrogate, 546
 Chloride of sodium. See *Sodium chloride*
 Chlorides in mineral waters, 325
 Chlorosis, 496, 501, **640**
 Chlorosis, importance of rest in, 366, 641, 642
 Chlorosis, in regard to seaside localities, 55
 Chobham Ridges, 273
 Cholagogue action of mineral waters, experiments in regard to, 452, 535, 547
 Cholelithiasis, 477, **709**; indications for mineral waters and spa-treatment, 710; indications for surgical interference, 710, 711; exercise and mountain resorts in the preventive treatment, 709
 Christchurch (near Bournemouth), 245
 Christiania, 285
 Christiansbrunnen at Liebwärda, 600
 Church Stretton, 275
 Churwalden, 141, 145, 503
 CHYZER, K., 10, 226, 601, 749
 Cicatrices, painful, 370
 Ciechocinek (Russian Poland), 232, **448**
 Cimiez, near Nice, 83
 Cintra, near Lisbon, 119
 Circulatory system, action of barium chloride on, 347, 401, 547
 Circulatory system, 'bad circulation' in the extremities, **698**, 742, 744
 Circulatory system, danger of high altitudes in degenerative conditions of, 63, 64, 694, 697
 Circulatory system, diseases of, 693. See also under *Heart*
 Circulatory system, state of, in connection with disorders of the abdominal viscera, 701

- Cirkvenica, 98
 Cisanello, 88
 Cities—great cities and therapeutic use of visits to them, 281, 667, 727
 'City' climates, &c. See under *Towns*, *large*
 'City' temperatures, 48
 Civillina water, 321, 522, 530
 Civita Vecchia, 578
 Clacton-on-Sea, 257
 Clairmont-sur-Sierre sanatorium, 154
 CLAR, CONRAD, 221, 679, 749
 Clarens, 150
 CLARK, SIR JAMES, 244
 Classification of climates, 52
 Classification of mineral waters, 318, 324, 330
 Clausthal (Harz Mountains), 199, 200, 607
 Clavadal, 139
 CLEMOW, F. G., 231, 317, 523, 580, 595, 749
 'Clergyman's sore throat,' 527, 539, 687
 Clermont-Ferrand, 179, 294, 323, 522
 Cleve, 186, 506
 Clevedon (Somerset), 249
 Clifton and Clifton Downs, 270, 280 (meteorological means), 294, 379
 Cliftonville (Margate), 238
 Climacteric period in women, 665
 Climate and climatology, definition, 15. See also under *Climates* and *Climato-therapy*
 Climate, determining factors of, 16
 Climate, influence of altitude and latitude on, 16, 37, 38, 55, 64, 65, 184, 262, 635; occasional influence of relatively slight differences in altitude as exemplified by British climates, 65, 262; effect of latitude in regard to the influence of altitude, 38, 55, 64, 65, 184, 262; influence of altitude on isolation and richness in 'chemical rays,' 28, 57, 135, 136; importance of latitude in regard to winter insolation for invalids, 635
 Climate, influence of artificial conditions introduced by man on, 16, 48, 282, 283
 Climate, influence of aspect, position, &c., in regard to 'local climates,' 32, 33, 48, 50, 237, 636
 Climate, influence of drainage of the soil and surface on, 16, 32, 47, 48, 49, 283
 Climate, influence of forests on, 50
 Climate, influence of large surfaces of water on, 51
 Climate, influence of latitude on. See under *Climate*, *influence of altitude and latitude on*
 Climate, influence of neighbouring glaciers and snowfields on, 51
 Climate, influence of neighbouring mountains on, 50, 51
 Climate, influence of situation in regard to atmospheric humidity, fogs, rainfall, sunshine, winds, &c., 16, 32, 33, 48, 50, 287, 636
 Climate, influence of soil and subsoil on, 16, 32, 47, 48, 49, 283
 Climate, influence of vegetation on, 16, 49, 50
 Climates. See also under *Climatotherapy*
 Climates, 'artificial' local climates of large towns, 48, 282, 283
 Climates, characteristics of the different classes of climates, 53
 Climates, classification of, 52
 Climates—climatic differences between different portions of the same health resort, 636
 Climates, coast, 54
 Climates, cold dry inland, 67
 Climates, 'continental' type of, 65
 Climates, desert, 66. See also *Egypt* and *Egyptian Climates*
 Climates, inland, 55
 Climates, inland, of high altitude. See *Climates of high altitude*
 Climates, inland, of large lakes, 66; Swiss lakes, 150, 157, 158, 159; North Italian Lakes, 161, 165
 Climates, inland, of moderate and low altitudes, 64, 65; influence of relatively slight differences in altitude, as exemplified by British climates, 65, 262
 Climates, inland, of plains, 65
 Climates, insular (small islands), 54
 Climates, 'local climates' due to local influences (sunshine, winds, &c.), 16, 48, 50, 237, 636
 Climates—'local climates' in the British Islands, 237
 Climates, marine, 53; ocean climates, 69
 Climates, marine, colder group of coast climates, 55
 Climates, marine, warmer group of coast climates, 55
 Climates, ocean, 69. See also under *Climates*, *marine*
 Climates of high altitude, 38, 55, 62, 134. See also under *Climatotherapy*, *climates of high altitude*
 Climates of high altitude, characteristics of, 38, 56
 Climates of high altitude—Swiss resorts of high-altitude compared with high-altitude resorts in other parts of the world, 136
 Climates of high altitude—typical high-altitude resorts, 62, 134, 136
 Climates of high altitude, winter sunshine at, 135, 136
 Climates of the colder islands, 133
 Climates, sea. See *Climates*, *marine*
 Climates, seaside. See *Climates*, *coast*
 Climates, treatment by. See *Climato-therapy*
 Climates, warm dry inland (desert climates), 66. See also *Egypt* and *Egyptian climates*
 Climates, 'weather sensations' as a proposed basis for classification of climates, 27, 52
 Climatology, general, 15. See also under *Climate*, *Climates*, and *Climatotherapy*
 Climatotherapy. See also *Climate* and *Climates*

- Climatotherapy, artificial modifications in climates due to drainage of the soil and the construction of large towns, 16, 48, 282, 283
- Climatotherapy, aspect of the house and room, importance of, 636
- Climatotherapy, associated therapeutic factors, 352, 354, 355, 613, 631, 635
- Climatotherapy, change in surroundings with regard to the effect of visits to health resorts, 631
- Climatotherapy, climates of high altitude, acclimatisation, 59, 64
- Climatotherapy, climates of high altitude, contra-indications, 63
- Climatotherapy, climates of high altitude, effects of, **58-64**, 675, 691, 719
- Climatotherapy, climates of high altitude, effects on the blood, 58, 60
- Climatotherapy, climates of high altitude, effects on the metabolism, 59
- Climatotherapy, climates of high altitude in regard to cardio-vascular changes, 63, 64, 694, 697
- Climatotherapy, climates of high altitude in the treatment of pulmonary tuberculosis, 675
- Climatotherapy, climates of high altitude, increase in chest measurement from, 691
- Climatotherapy, climates of high altitude, indications for, 62
- Climatotherapy, climates of high altitude, influence on the menstrual functions, 719
- Climatotherapy, climatic factors in spa treatment, 353
- Climatotherapy, clothing in regard to visits to health resorts, 623
- Climatotherapy, cold climates, contra-indications, 68
- Climatotherapy, constitution of the patient in regard to the selection of health resorts, **632**, 644, 671. See also under *Reactive powers, individual*
- Climatotherapy, definition, 15
- Climatotherapy, 'desert climates' in cases of pulmonary tuberculosis, 678
- Climatotherapy, diet in connection with. See *Diet at health resorts*
- Climatotherapy, different climates suitable for different races and different individuals, 15
- Climatotherapy, healthiness of a locality in connection with the density of its population, local industries and factories, 16
- Climatotherapy, importance of latitude in regard to winter insolation for invalids, 635
- Climatotherapy, indications for treatment, 611. See also under *Selection of a health resort*, and under the names of the various diseases and morbid conditions
- Climatotherapy, intermediate stations to high-altitude resorts. See *Intermediate stations*
- Climatotherapy, journey to health resorts, 354, 616, 617, **634**
- Climatotherapy, local medical advice at health resorts, importance of, 365, 617, **623**. See also *Medical supervision at health resorts*
- Climatotherapy, localities for an 'after-cure' to spa-treatment, 605-610. See also under *After-cure*
- Climatotherapy, marine climates, effects of, 55; effects of ocean voyages, 73
- Climatotherapy, marine climates for scrofulous children, 682
- Climatotherapy, massage and active and passive exercises in connection with treatment at health resorts, **356**, 614. See also under *Massage and Exercises*
- Climatotherapy, meaning of 'a good climate,' 15, 235
- Climatotherapy, open-air treatment at ordinary health resorts, 352, 353, 356, **635**; opportunities for open-air treatment in regard to the selection of a health resort, 635
- Climatotherapy, psychical influences in treatment at health resorts, 354, 613, 614. See also under *Mental factor*
- Climatotherapy, reactive powers, individual, in regard to therapeutic indications, 55, 312, **632**, **633**, 644, 671, 682. See also under *Constitution of the patient*
- Climatotherapy, rest and recreation at health resorts, &c., 281, 354, 355, **613**, 631
- Climatotherapy, sanatorium treatment at health resorts, 416, 625, 627, 668, 672, 676, 680, 699; sanatorium treatment at climatic resorts in cases of pulmonary tuberculosis, 627, 668, 672, 676, 680
- Climatotherapy, sea air, effects of, 53-55
- Climatotherapy, seasons for sea-bathing, 451
- Climatotherapy, seasons for treatment at health resorts, 16, 354, 367, 451, 609, **634**
- Climatotherapy, selection of a health resort, general considerations, 631. See also *Selection of a health resort*
- Climatotherapy, selection of houses and rooms, 636, 637
- Climatotherapy, sexual functions and development influenced by climate, 25, 719, 723
- Climatotherapy, suitability of resorts for invalids dependent on the time of year, 16. See also *Seasons for treatment at health resorts*
- Climatotherapy, uncertainty in regard to 'weather,' 623, 631
- Climatotherapy, warm climates, effects of occasional and habitual application of heat to the surface of the body contrasted, 309
- Climatotherapy, warm climates, influence on sexual functions and development, 25, 719, 723

- Climbing exercise at health resorts, 358.
 See also *Terrain-Cur*
- Clothing in regard to visits to health resorts, 623
- Clouds, 34
- Clovelly, 249
- Cluny Hill Hydropathic (near Forres), 279
- Clyde, Firth of, resorts on, 253
- Coatham (Redcar), 255
- Cochem, 189
- COHEN, S. SOLIS, 10, 27, 41, 64, 75, 654, 680, 696
- COHNHEIM, J., 698
- Coise, 604
- Col-du-Chat (above the Lake of Bourget), 172, 545
- Colberg. See *Kolberg*
- Cold-water cure (treatment). See *Hydrotherapy*
- Coldbath Wells, 504
- Coldharbour, 273
- Colica mucosa, 706
- Colitis, chronic catarrhal, 705, 706, 707
- Colitis, muco-membranous, 389, 470, 548, 706
- COLLIN, H., 749
- Cologne, 274
- 'Colonia Aurelia Aquensis.' See *Baden-Baden*
- Colorado Springs, compared, 137
- Colwyn Bay, 251
- Combballaz, La, 148
- COMBE, A., 706
- Common salt. See *Sodium chloride*
- Common salt waters. See *Muriated waters*
- Como, 163
- Como, Lago di, 163
- Compressed air baths, 41, 432, 465, 689
- Compressed air, effects of, 41
- Condal water, 488, 495
- Condamine, La (Monaco), 84
- 'Condensation-nuclei' of fogs and clouds, 34
- Condillac, 599
- Conishead Priory ('hydropathic'), 276, 314
- Coniston, 276
- Connemara district (Galway), 279
- Constance, 159, 294, 314
- Constance, Lake of, 159
- Constantinople, 100, 292, 293
- Constantinquelle of Gleichenberg, 468
- Constantinsbad (Neudorf), 517
- Constanza (Roumania), 230
- Constipation, 488, 534, 547, 666, 704, 733
- Constipation, habitual, 704
- Constipation, habitual, in feeble and neurasthenic individuals, 704
- Constipation, habitual, with 'colica mucosa' and muco-membranous colitis, 706
- Constipation, headaches and other symptoms of 'intestinal auto-intoxication' often due to associated intestinal catarrh rather than to the mere constipation, 705, 733
- Constipation in old age, 666
- Constipation, natural frequency of defaecation varies much in different individuals, 704
- Constitution of the patient in regard to the selection of health resorts, 632, 644, 671; originally strong constitutions, 632, 671; originally weak constitutions, 633, 644, 671. See also under *Reactive powers, individual*
- Constitutional disorders, 638
- Consumption, pulmonary. See *Tuberculosis, pulmonary.*
- CONTE, 740
- 'Continental' climates. See *Climates, 'continental' type of*
- Contrexéville, 182, 321, 582, 583, 586, 653, 710, 715
- Convalescence, 638
- Convalescence from acute rheumatism, 654
- Conway, 251
- Cookham (Thames), 271
- Copenhagen, 285
- Copenhagen, seaside resorts near, 132
- Copper sulphate in mineral waters, 327, 528, 529, 604
- Corbières, Les (Mont-Revard), 172, 545, 608
- Corfu, 99, 236
- Cork Harbour, resorts of, 258
- CORMACK, C. E., 749
- CORNET, G., 749
- Cornwall, coast of, 247
- Corpo di Cava, 91
- Corpulence. See *Obesity*
- CORRE, 602
- CORRIGAN, Sir J. D., 121
- Corsica, 92
- Cortegada, 170, 579
- Cortina-di-Ampezzo, 217, 607
- Corunna, 119
- Coryza. See under *Nose*
- Costebelle, 81
- Cotswold Hills, 271
- Cotswold Sanatorium, 271
- COUPLAND, S., 753
- Couret, 574
- Courmayeur, 167, 608
- COURMONT, J., 749
- Court-Saint-Etienne, 526
- Couzan (Sail-sous-Couzan), 181, 598
- Cowes (Isle of Wight), 243
- Craigellachie, 279
- Craiglockhart Hydropathic, near Edinburgh, 284
- Crail (Fife), 255
- Crampas (Island of Ruegen), 128
- Cranleigh, 272
- Cransac, 592
- Crevasse, Source de la, at Saint-Honoré, 526, 573
- Criccieth, 251
- Crieff, 278, 314
- Crimean resorts and mud baths at, 100, 337
- Crise thermale. See *Poussee thermale*
- Cristal-Château water, 599

- Croatia, health resorts of, 229
 Croft Spa (Yorkshire), 548
 Croisic, Le, 122
 Cromer, 256
 Cronberg, 191
 Cronthal (Kronthal) springs, 192, 598
 Crook, J. K., 317, 749
 Crooksbury Ridges (near Farnham), 273
 Crooksbury Sanatorium (near Farnham), 273
 Crossley Sanatorium in Delamere Forest, 275
 Crowborough, 268, **272**, 273
 Croydon, neighbourhood of, 295
 Cruden Bay, 254
 CRUICKSHANK, B., 254
 CRUICK, Sir F. R., 587
 Cruzy, 491
 Cryoscopy of mineral waters, 319, 320, 321
 Crystal Palace neighbourhood (London), 284
 Csiz, 436
 Csorba Lake (Hungary), 227
 Cuckfield (Sussex), 274
 Cudowa, Bad, 206, **505**, 530
 CULLEN, WILLIAM, 303
 CULLMORE, D. H., 750
 Cupping (dry cupping) at Bourbon-l'Archambault, 440
 'Cure' (German, Cur or Kur), ordinary use of the term, 369
 CURIE, P., 321, 322, 328, 372, 382, 388
 CURRIE, JAMES, 750
 Cusset (near Vichy), 180, **455**
 Cutaneous affections. See under *Skin*
 Cutigliano (Apennines), 168
 Cuxhaven, 127
 Cyclic albuminuria. See *Albuminuria, cyclic and postural*
 Cycling exercise and 'cyclotherapy,' 358, 410
 Cyclones, 39, 46
 Cyclonic systems, local, in mountainous regions, 46
 'Cyclotherapy.' See *Cycling exercise and 'cyclotherapy'*
 Cystitis. See under *Urinary bladder*
 CZERNY, 782
 Czigelka, 469

 DAILY life at Spas. See *Spa-treatment, daily life at spas*
 Dalkey, 261
 Dames, Source des, at Plombières, 389
 Dames, Source des, at Saint-Nectaire, 525
 Dames, Source des, at Saint-Sauveur, 567
 Daneswood Sanatorium (Woburn Sands), 275
 Dangast, 127
 DANVERS, H., 750
 Danzig, 294
 DAPPER, C., 343, 402, 403, 475, 702, 703, 706, 712, 750, 763
 DAQUIN, 544
 Darjeeling, compared, 137
 Darkau, Bad, 207, **436**
 Dartmoor, 269
 Dartmouth, 247
 Daruvar, 229, **385**
 Datchet (Thames), 271
 Davos, **138**, 607
 Davos, sanatorium treatment at, 627
 Davos-Dörfl, 139
 Davos-Platz, 138
 Dawlish, 247
 Dax, 178, 337, 367, **393**, 444, 634
 Deal, 239
 Deauville, 124
 D'ARBOIT DE JUBAINVILLE, L., 750
 Debility, general, **640**, 644. See also *Neurasthenia and Anemic conditions*
 Debility, general, due to hypoplasia in development, 642
 Debility, general, rest and open-air treatment combined, 644
 Debility, general, with originally weak constitution, 644
 Debility, nervous. See *Neurasthenia*
 DEBOUT D'ESTRÈES, 583, 587, 750
 D'ECHAILLON (Savoie), 445
 DEDET, 750
 Deeside Hydropathic, 254, 278
 Deeside, resorts of the, 278
 Definition of climate, climatotherapy, &c., 15
 Definition of hydrotherapy, balneotherapy, &c., 299, 300
 Definition of 'mineral water,' 316
 Definition of 'spa-treatment,' 299
 Definition of term 'Cure,' when equivalent to German 'Cur,' 369
 Definition of 'weather,' 15
 Delamere Forest, sanatorium in, 275
 DELASTRE, P., 490, 750
 DELFAU, G., 750
 DELMAS, M., 750
 Denmark, seaside resorts of, 132
 DENT, 62
 Denver, compared, 137
 DEPIERRIS, 349, 740
 Depression, mental. See *Mental depression*
 DERMITZEL, 304
 DERSCHIED, G., 672, 750
 Désaignes, 461
 Desert (warm dry inland) climates, **66**, 678. See also *Egypt and Egyptian climates*
 DETERMANN, 197
 Detmold, 209
 DETTWELER, P., 191, 627, 629, 750
 Deutsch-Altenburg. See *Altenburg*
 Deux Reines, Source des, at Aix-les-Bains, 543, 599
 Devil's Dyke (Brighton), 242
 Devonshire, north coast of, 249
 Devonshire, south coast of, 246
 Dew-point of the atmosphere, 33
 DEWAR, J., 17
 Diabetes insipidus, 732
 Diabetes mellitus, 457, 477, 583, **661**
 Diabetes mellitus, grave cases, 583, **661**
 Diabetes mellitus, mild cases, 457, 477, 583, **662**

- Diablerets, Hôtel des, 148
 Diarrhœa, chronic, 597, **705**
 Diarrhœa, 'morning diarrhœa,' 597, **705**
 Dickinson, W. H., 247, 248, 750, **773**
 Diemer, F., 329, 599
 Dienne sanatorium (France), 180
 Dieppe, 124
 Diet during the internal use of chalybeate waters, 496, 497
 Diet during the internal use of muriated waters, 403
 Diet during the internal use of sulphated-alkaline waters, 474, 475, 478
 Diet during treatment at health resorts, 355, 366, 403, 474, 475, 478, 496, 497, 585, **615**
 Diet, experiments with regard to meat diet in animals, 652, 653, 685
 Diet, importance of qualitative change of, 733, 734
 Diet, importance of quantitative change of, 733
 Diet in regard to affections of the urinary organs, 585, 713, 714
 Diet in regard to disorders of the digestive system, 403, 700, 706, 733
 Diet in regard to fatty food when taking mineral waters, 403, 475, 497
 Diet in regard to gouty conditions, 651, 652
 Diet in regard to intestinal auto-intoxication, 733
 Diet in regard to migraine, 736
 Diet in regard to muco-membranous colitis, 706
 Diet in regard to tuberculosis and scrofulous conditions, 683-686
 Diet in regard to uric acid gravel, 714
 Diet, salt-free, mineral waters in regard to, 713
 Dietsenmühle, 314
 Dievenow, **129**, 131
 Digestive system, diseases and disorders of, 400-403, **699**. See also under *Stomach*, *Intestines*, and *Dyspepsia*
 Digestive system, disorders of, treatment in sanatoriums at health resorts, 699
 Digne, 173, **572**
 Dinan, 122, 294
 Dinant, 184, 314
 Dinard, 122
 Dingle (Kerry), 259
 Dinkholder-Brunnen (near Braubach), 516
 Dinsdale-on-Tees, 268, 548
 DIRUF, O., 750, **751**
 Disentis, 146
 Dittersbach, 204
 Divonne-les-Bains, **153**, 160, 181, 314
 Dobelbad or Döbelbad. See *Tobelbad*
 Doberan, 128
 Dolder hotel, above Zürich, 158, 608
 'Doldrums,' 71
 Dolcoed Hotel (Llanwrtyd), 267
 Dolgelly, 277
 Dollar, Vicar's Bridge spring near, 504
 'Dominique' spring of Vals, 531
 Domodossola, 166
 Donaghadee, 260
 Dorheim (Germania-Brunnen), 598
 Dorking, 272
 Dorking, hills near, 273
 Dorna-Scharu (Roumania), 230
 Dornoch, 254
 Dorotheen-Säuerling of Karlsbad, 476, 600
 Dorsetshire, coast of, 245
 Dorton chalybeate water, 504
 Doses of arsenical chalybeate (sulphate of iron) waters, 529, 530
 Doses of purgative mineral waters, 495, 547
 Douche, alternating, 303, **729**
 'Douche ascendante,' 331, **389**
 Douche écossaise. See *Douche, Scotch*
 Douche 'en cercle' or 'needle douche,' 303
 'Douche horizontale,' 331, 389, 548
 Douche, hydro-electric, 303
 'Douche interne,' 331
 Douche, intestinal (lavage of the large intestine), 331, 389, 548
 Douche-massage, 357, 455, 542, **544**, 547, 571, 581, 729; introduction of, 544
 Douche-massage at Aachen (Aix-la-Chapelle), 542
 Douche-massage at Aix-les-Bains, 544
 Douche-massage at Helouan, 581
 Douche-massage at Uriage, 571
 Douche-massage at Vichy, 455
 Douche, 'needle,' 303
 Douche, Plombières, 389, 548
 Douche, Scotch (douche écossaise), 303, 311, 729; origin of the term, 303
 Douche, 'submarine' or 'under water,' 303, 389, 440, 548
 Douche, 'submassive,' 548
 'Douche Tivoli' of Plombières, 303, 389, 441, 548
 Douches, forcible, with massage effect, 357, 441
 Douches of carbonic acid gas, 335
 Douches of mineral waters, 331
 Douches, various forms and uses of, **303**, 305, 311, 331, 335, 357, 389, 441, 544, 729; various local douches, 331
 DOUGLAS, C. G., 62
 Douglas (Isle of Man), 253
 Dover, 239
 Dovercourt, 257
 Dowsing electric light baths, 304, 305, 548
 DOYON, A., 571, 751
 Drainage of the soil and surface, as affecting climate, 16, 32, 47, 48, 49, 283
 Drei Aehren (Vosges Mountains), **193**, 607
 DRESCH, 366, **751**
 Dresden, 286, 287; artificial mineral water treatment introduced by Struve at, 351; sand baths introduced at, 340
 Driburg, 208, 237, **507**, 588
 DRIVER, 208
 Droitwich, 265, 400, **404**
 Dublin, 285
 Dublin, neighbouring country, 260, 285

- Dublin Bay, resorts on, 260
 DUBOIN, A., 346, 466
 DUCKWORTH, Sir DYCE, 651, 684, 751
 DUCROËT, 471
 DUENSCHMANN, H., 342
 Duerkheim, 193, **431**, 622
 Duerrenberg, 434
 Duerrenstein Hotel (Tirol), 217, 607
 Duerrheim, 196, **430**
 Duesternbrook, 128
 DUFRESSE DE CHASSAIGNE, J. E., 180, 334, 573, 751
 DUHOURCAU, E., 341, 348, 533, 751
 Duin-en-Dal (near Haarlem), 126
 DUJARDIN-BEAUMETZ, G., 751
 DUKES, CLEMENT, 618, 714
 Dulwich, 293
 Dulwich Spa, 504
 Dunbar, 255
 Dunblane, 277, 314, 422
 DUNCAN, MATTHEWS, 722
 Dundrum (Dublin), 261
 Dundrum (Dundrum Bay), 260
 Dunkerque. See *Dunkirk*
 Dunkirk, 125
 Dunmore (Ireland), 261
 Dunoon, 253
 DURAND-FARDEL, M., 10, 751
 Duration of courses of spa-treatment, 365
 Durdham Downs, 270
 Durham, 294
 Durtol Sanatorium (France), 179
 Dust, dangers of in regard to pulmonary tuberculosis, 669
 Dust, dusty roads and their treatment, 16, 19
 Dust in the atmosphere, 19
 Dust, meteoric, 19
 Dust, organic, 19
 Dust, smoke and fogs, in regard to the climate of large towns, 30, 31, 48, 283, 284
 Dust, volcanic, 19
 DVORAK, J., 685
 DWORETZKY, A., 751
 Dymchurch, 240
 Dysmenorrhœa, 720
 Dyspepsia and chronic gastric disorders, 400-403, 452, 562, 582, 592, 596, **699**, 702, 716
 Dyspepsia and chronic gastric disorders, experiments of Bickel and others in regard to the local action of mineral waters when taken internally, 401-403
 Dyspepsia, atonic, 702, 703
 Dyspepsia, climatotherapy in, 699
 Dyspepsia, hydrotherapy in, 701
 • Dyspepsia, importance of holidays, travelling and open-air exercise in the treatment of, 700
 Dyspepsia in old age, 702
 Dyspepsia, nervous and neurasthenic, 703
 Dyspepsia, spa-treatment in, 702; alkaline waters in, 452; muriated waters in, 400-403
 Dyspepsia, with oxaluria, 716
 Dyspepsia, with 'weak mucous membranes,' 701
 EALING, 295
 EARDLEY-WILMOT, R., 751
 Earlsferry (Fife), 255
 Ears, affections of the, 450, **739**; danger of sea-bathing in some cases, 450, 740
 Earthy group of table waters, 597, **599**
 Earthy mineral waters, 327, 348, **582**, 653. See also *Earthy mineral waters, alkaline*
 Earthy mineral waters, alkaline, 327, 348, 582, 653, 715, 720, 735, 743
 Earthy salts in mineral waters, comparative table, 582
 Easebourne Hill, near Midhurst, 273
 East Anglian Sanatorium (Suffolk), 275
 East Grinstead, 274
 East Indies, voyages to, 70
 Eastbourne, **241**, 280 (meteorological means)
 'Eau-Mère.' See *Mutterlauge*.
 Eau-Verte, Source, of Montmirail, 321, 489, 495
 'Eaux bicarbonatées mixtes,' 327
 'Eaux oligo-métalliques chaudes.' See *Simple thermal waters*
 'Eaux oligo-métalliques froides.' See *Weakly mineralised cold waters*
 Eaux-Bonnes, 176, 321, 533, **540**
 Eaux-Bonnes, sanatorium near, 541
 Eaux-Chaudes, 176, **564**
 EBBESEN, 580, 751
 Ebensee (Traunsee), 220; Ebensee brine, 220, 435
 EDERMAYER, E., 50, 751
 Ebersteinburg sanatorium, 419
 Eberswalde, 208, **508**
 Echaillon, D' (Savoie), 445
 Eczema, 387, 560, 570, 583, **742**, **743**.
 See also under *Skin*
 Eczema, 'seborrhœic,' 743
 Edenkoben, 193, 622
 Edgecombe, W., 320, 347, 348, 535, 546, 547, 745
 Edinburgh, 284; meteorological means, 293; suburbs and surrounding country, 284
 EDINGER, L., 649
 Effervescent baths. See *Gaseous (effervescent) baths*
 EGASSE, E., 326, 491, 751
 EGGER, E., 60, 751
 Eggerhof (above Meran), 218
 Eggishorn (Eggischhorn), the, **147**, 607, 608
 Egham (Thames), 271
 Egypt, 101
 Egyptian climates, 105; indications and contra-indications, 106, 107; desert climates in pulmonary tuberculosis, 678
 Eibesberg (Styria), 223
 Eichwald (near Teplitz-Schönau), 225
 Eidsvoll (Norway), 185
 Eifel, resorts of the, 188
 Eilsen, Bad, 209, 336, 337, **554**
 Eisenach, **201**, 294, 314, **427**
 El Biar (Algiers), 108
 Elan Valley Hotel (Wales), **276**, 610
 Elba, 89, 524

- Electric baths, 303
 Electric four-cell bath ('Vierzellenbad'), 303
 Electric light and 'radiant heat' baths, 304, 305, 306
 Electrical conductivity of mineral waters, 319
 'Electrical dissociation' of solutions in regard to mineral waters, 318, 319
 Electricity, atmospheric. See *Atmosphere, electrical phenomena*
 Electrolytic methods and absorption from baths, 304, 332, 658
 Electrolytic methods, 'ions' of chlorine, &c., made to penetrate through the skin, 304, 332, 658
 Elgersburg (hydrotherapy), 201, 314, 607
 Elie (Rife), 255
 Elisabeth spring of Homburg, 320, 411
 Elisabeth spring of Kreuznach, 411
 'Elisenbrunnen' at Aachen, 542
 ELLIOT, JOHN, 752
 Elmen, 429
 Eloepatak, 227, 516
 Elorrio, 579
 ELSNER, F. W., 773
 Elster, Bad, 224, 485, 513, 721
 ELSTER, J., 57, 322, 328, 330, 395, 406, 752
 Ely, 294
 Emerita spring of Tarasp, 484
 Emilienbad (Grewzach), 493
 Emma-Heilquelle of Lamscheid, 507
 Emmaquelle of Gleichenberg, 468
 Emond, E. E., 752
 Empfing, Wildbad, 324, 603
 Emphysema of the lungs, 432, 464, 609, 688, 692. See also *Bronchitis, chronic*.
 Ems, 189, 368, 464, 689, 721, 722
 Emskopf, the (Harth Forest), sanatorium treatment, 202, 509
 Encausse, 593
 Endometritis, chronic, 721. See also under *Uterus*.
 Engadine, Lower, 144
 Engadine, Upper, 140, 143, 606; suitable for an after-cure to spa-treatment, 606
 ENGEL, F., 102, 752
 Engelberg (Switzerland), 158, 608
 ENGELMANN, F., 342
 ENGELSTAD, 132
 Enghien-les-Bains, 183, 321, 573
 England, chalybeate springs of, 503
 England, inland health resorts, 261, 268
 England, localities for an after-cure to spa-treatment, 609
 England, seaside resorts, 238, 255
 Engstlenalp (above Giessbach), 149
 Enniskerry, 261
 Enteritis (chronic forms). See under *Intestines*
 Enuresis, nocturnal. See *Urine, nocturnal incontinence of*
 Enzyme action, in regard to possible action of mineral waters, 328
 Eperies, Szinye-Lipocz near, 460
 Epilepsy, 725
 Epping Forest, 274
 Epsom and Epsom Downs, 272, 273
 Epsom bitter water, 489
 EPSTEIN, E., 749
 Equability of climates, 53
 Equator, distance from (latitude), influence of on climate. See *Climate, influence of altitude and latitude on*
 Equatorial calms, 71
 ERB, W., 63, 752
 Erdoebenyé, 524
 ERK, 45
 Ernst Ludwig Sanatorium (Odenwald), 194
 Erzenberg Sanatorium (Langenbruck), 160
 Erzgebirge, resorts of the, 203
 Escaldes, Les (Andorra), 175
 Escaldes, Les (France), 175, 570
 ESCAT, E., 740
 Escholzmatz, 157
 Escorial (Spain), 170
 Escoriaza, 579
 Escouloubre, 574
 ESMONET, 173, 342, 488
 Essentuki (Caucasus), 232, 473
 Etivaz, I., 564
 Etretat, 124
 Euganean Hills (Italy) and the 'Euganean thermæ,' 167, 395, 445
 'Eugénie' spring of Royat, 465, 466
 Eugénie-les-Bains, 574
 Fuzet, 574
 Evaux-les-Bains, 181, 391
 Eversfield Hospital for tuberculosis (St. Leonards), 241
 Evian-les-Bains, 153, 321, 599, 602
 Evolena, 147
 EWALD, C. A., 752
 EWART, W., 48, 239, 241, 242, 282, 752, 773
 EWICH, O., 351, 752
 Exercises, active and passive, in chronic affections of the heart and circulatory systems, 358-362
 Exercises, active and passive, in connection with treatment at health resorts, 356, 614
 Exercises, active and passive, uses of, 358-362
 Exercises for the muscular incoordination of tabes dorsalis. See *Frenkel's exercises*
 Exercises, graduated walking and climbing exercise, 358. See also *Terrain-Cur*
 Exercises, Nauheim. See *Nauheim treatment* and *Schott resistance-exercises*
 Exercises, open-air exercise. See *Open-air exercise*
 Exercises, 'resistance-exercises' (Widerstands-Gymnastik), 357-362, 408. See also *Exercises, active and passive, and Nauheim treatment*
 Exercises, respiratory, 361, 362, 464, 679, 701, 709

- Exercises, respiratory, by expiration into rarefied air and inspiration from compressed air, in cases of pulmonary emphysema, 464, 465
- Exercises, respiratory, in disorders of the circulation, 361, 362
- Exercises, respiratory, in disorders of the liver, 362, 709
- Exercises, respiratory, in pulmonary tuberculosis, 679
- Exercises, respiratory, in regard to the circulation of blood and lymph in the abdomen and thorax, 362, 701
- Exercises, 'Schott exercises.' See under *Schott resistance-exercises* and *Nauheim treatment*
- Exercises, tricycles employed for graduated active and passive exercises ('cyclotherapy'), 358, 410
- Exercises, walking and climbing exercise in the prevention of cholelithiasis, 709
- Exeter, 294
- Exmoor, 269
- Exmouth, 247
- Exophthalmic goitre. See *Graves's disease*
- Expense in regard to treatment at health resorts, 635
- Eyach-Sprudel, 598
- Eyes, affections of the, 738
- Eyes, conjunctival form of 'hay fever,' 691
- EYRE, J. J., 289, 446
- Eze (Eza), 83
- FABER, C., 677, 752
- Fachingen water, 190, 452, **458**, 598
- Falkenstein sanatorium, 191, 627, 629, 679
- FALLOPIUS, 594
- Falmouth, 236, **247**, 280
- 'Family' piscines at Continental spas, 519
- 'Fango' baths, 336-339, 378, 379, 395, 418, 445, 446, 485, 561, **575**. See also *Mud baths*
- 'Fango,' radio-activity of, 330; radium and radio-active minerals in fango and mineral-water muds used for mud baths, 330, 339, 395
- FANNING, F. W. BURTON, 674, 749
- FANNING, W. J., 674
- Farette, 521
- Farnborough, 274, 314
- Farnbuehl, 519
- Farnham, 272
- Faröe Islands, 133
- Fasano (Lago di Garda), 163, **164**
- Fasciæ, inflammation in gonorrhœal rheumatism, &c., 655. See also under *Fibrositis*
- Fassa Valley. See *Vigo-di-Fassa*
- Fatness. See *Obesity*
- Faulenseebad, 156, **590**
- FAURE, M., 567
- Fayet, Le. See *Saint-Gervais*
- FAYER, Sir J., 477
- Féocamp, 124
- Feet, cold feet and 'bad circulation' in the extremities, **698**, 742, 744
- Feldberg (Black Forest), the, 198
- Feldberg (Taunus), the, 192
- FELIX, J., 341, 372, 392, 400, 463, 469, 533, 715, 752
- Felixfürdö (Grosswardein). See *Grosswardein*
- Felixstowe, 257
- FELKIN, R. W., 72
- Fellach. See *Vellach*
- Fellathalquellen, 459
- FELLNER, L., 482, 752
- Felsenegg (Switzerland), 158, 314
- Fenestre springs at La Bourboule, 526
- Ferdinand spring, of Marienbad, 321, 322, 479, 480
- FERRAS, J., 740
- 'Ferras' spring of Luchon, 537
- FERREYROLLEN, 527
- Ferric salts in mineral waters, 323, 326
- FERRIER, PAUL, 678
- Ferrous salts in mineral waters, 323, 326
- Ferruginous baths. See *Iron baths*
- Ferruginous peat baths. See *Peat baths*
- Ferruginous waters. See *Chalybeate waters*
- Festiniog Village (Wales), 276
- Fettan, 145
- Festiniog Village (Wales). See *Festiniog*
- 'Fibroids' of the uterus. See *Uterus, fibroid tumours of*
- 'Fibrositis,' 310, 311, 357, 372, 543, 547, 574, 581, **658**
- Fichtelgebirge, health resorts in the, 202
- Fideris, Bad, 145, **518**, 601
- Fiesole, near Florence, 290
- Fièvre thermale. See *Poussée thermale*
- Filey, **256**, 421
- Finchley, 284, 295
- Finhaut (Switzerland), **147**, 154
- Finistère, 122
- FINK, F., 710
- FINSEN, N., 28
- Firenze. See *Florence*
- Fitero (Spain), 170, **397**
- Fiuggi water (Italy), 321, **602**
- Flamstead (Hertford), 274
- FLECHSIG, R., 10, 752
- Fleetwood, 252
- FLEINER, W., 734, 752
- FLEURY, L., 300, 752
- Flims and the Flimser Waldhäuser, **146**, 609, 692
- FLINN, D. E., 258, 259, 285, 553, 752
- Flinsberg, 205, **506**
- Flitwick Well, 268, **503**
- Florence, **290**, 291 (meteorological means)
- FLÜGGE, C., 20
- Fluehli-im-Entlebuch, 564
- Flushing (Falmouth Harbour), 247
- Flyrsö sanatorium (near Gothenburg), 132
- Foce, La (Corsica), 94
- Foehn wind, explanation of, 45, 46
- Foehr, 127

- Fogs, 19, 30, 31, **34**, 48; 'condensation-nuclei,' 34
 Fogs and smoke, effect on the climate (loss of sunshine and sunlight, &c.) of large towns, 19, 30, 31, 48, 283, 284
 Fogs, the 'black fogs' of London, 19, 48, 282
 Folkestone, 240
 Foncande, 392
 Fontainebleau, 183, 287, 294
 'Fontes Leucogaei.' See *Pisciarelli springs*
 'Fontes Mattiaci.' See *Wiesbaden*
 FORBES, N. H., 752
 FOREL, F. A., 150
 FORESTIER, H., 303, 360, 543, 752
 Forges-les-Bains, and sanatorium at (Seine-et-Oise), 183, 521
 Forges-les-Eaux (Seine-Inférieure), 521
 Forests, influence of, on the atmosphere and climate of a locality, 50
 Formaldehyde in the atmosphere, 18
 Forres (Scotland), 279
 'Fortuna' mineral water (Germany), 598
 Fortuna (Spain), 448
 Foster-Green Hospital for Consumptives (near Belfort), 260
 FOSTER, M. G., 10, 35, 59, 79, 101, 635, 753, 772
 Fourchambault, 599
 FOURNIER, J. A., 722
 Fowey (Cornwall), 247
 FOWLER, J. K., 753
 Fox, R. F., 551, 753
 Fox, WILSON, 753
 FOXWELL, A., 753
 FRAENKEL, C., 685
 France, health resorts of Central France, 178
 France, health resorts of the Auvergne Mountains, 178
 France, health resorts of the Cevennes, 180
 France, health resorts of the French Alps, 170
 France, health resorts of the Jura Mountains, 181
 France, health resorts of the Vosges Mountains, 182
 France, inland resorts of, 170-183
 France, the northern coast of, 122
 France, the northern inland resorts, 183
 France, the north-west coast of, 122
 France, the Pyrenean health resorts, 174
 France, the Riviera coast, 78
 France, the west coast of, 120
 FRANCIS, 118
 FRANCKEN, W., 126, 753
 FRANÇOIS, J., 751
 'Franconian Switzerland,' resorts in the, 202
 Frankenhausen, 200, **426**
 Frankenwald, health resorts in the, 202
 Frankfurt on the Main, 286, 287, 625
 FRANKLAND, Sir E., 324
 Frant (near Tunbridge Wells), 263
 Franz-Josef water, 488, 494
 FRANZE, P. C., 304, 753
 Franzensbad, 224, 322, 336, 337, **481**, 514, 609, 695, 719, 721
 Franzensquelle, of Franzensbad, 322, 481, 483
 Frascati (Alban Mountains), 169
 Frauenkirch, 139
 FREBAULT, A., 537
 Fredriksvaern sanatorium (near Laurvik), 133
 FREEMAN, H. W., 753
 Freiburg-im-Breisgau, **198**, 294, 296
 Freienwalde, 208, 508
 Freiernbach (Black Forest), 196, **511**
 Freiwaldau. See *Graefenberg-Freiwaldau*
 Frenkel's exercises for the muscular inco-ordination of tabes dorsalis, 159, 180, 363, 423, 520, 615, **728**
 Fresh-air treatment. See *Open-air treatment*
 Freshwater Gate (Isle of Wight), 244
 Freudenstadt (Black Forest), **196**, 607
 Freyersbach, 418
 Fridau or Friedau (Swiss Jura), 160
 FRIEDLAENDER, R., 753
 FRIEDRICH, E., 753
 Friedrichroda, **200**, 607, 609
 Friedrichshafen (Lake of Constance), 159
 Friedrichshall water, 202, 320, **489**, 495
 Friedrichsheim sanatorium (Black Forest), 197
 Frimley and its neighbourhood, 273, 274
 Frinton-on-Sea, 257
 Frisian Islands, 126, 127
 Frohburg (Swiss Jura), 160
 FROMM, B., 748, 753
 FROUSSARD, P., 706
 'Fruit cures,' 622
 Fuerdoe (fürdő), meaning of, 227
 Fuered (Balaton-Fuered), 229, **601**
 Fuered, meaning of the Hungarian word, 227
 Fumades, Les, 574
 Funchal (Madeira) **112**, 236; voyage to Madeira, 69
 FUNDNER, A., 334, 753
 Furka route (Switzerland), resorts of, 146
 Furnas (Las) valley springs (San Miguel), 116
 Furness Abbey, 276
 Furunculosis, 534, **743**
 Fusch (Fuscherbad), 221, **601**, 602
 Fylde Coast, the (Lancashire), 252
 GABERNIGG, 459
 GADSDEN, JOHN OF, 27, 28
 GAGER, C., 753
 Gais (Appenzell), 159, 621
 GALBRAITH, J. J., 685
 GALEN, 666, 668
 Gall-bladder concretions. See *Cholelithiasis*
 Galthof (Moravia), 489, 495
 Gandersheim, 434
 Garda, Lago di, 163; the 'Riviera' of the, 163

- Gardone-Riviera**, 163, **164**, 165, 166, 236
(winter temperature)
- GARELLI, G.**, 753
- Gargling with mineral waters, 349
- Gargnano (Lago di Garda), 164
- Garmisch**, **213**, 608
- GARRIGOU, F.**, 175, 460, 565, 753
- GARROD, A. E.**, 404, 753, 773
- GARROD, Sir A. B.**, 656, 754
- Gas (carbonic acid) baths and douches, 335, 336, 482
- Gas (carbonic acid) baths, confusion with gaseous (effervescent) baths, 336, 695
- Gas (sulphuretted hydrogen) baths. See *Sulphuretted hydrogen gas baths* and *Sulphurous vapour baths, natural*
- Gaseous (effervescent) baths, **333**, **334**, **407**, 466, 480, 483, 485, 486, **497**, 499, 500. See also *Thermal-Soolbaeder*
- Gaseous (effervescent) baths, artificial, 351; oxygen instead of carbonic acid gas employed to produce effervescence, 547
- Gaseous iron baths, 333, 497. See also *Gaseous (effervescent) baths*
- Gaseous iron baths, artificial, 351, 547
- Gaseous thermal muriated baths. See *Thermal-Soolbaeder*
- Gaseous waters, internal use (and abuse) of, 343, 597
- Gaseous waters, simple. See *Table waters*
- Gases in bath water, absorption of, 333
- Gases in bath water, effect of, 333. See also *Gaseous (effervescent) baths*, and *Thermal-Soolbaeder*
- Gases in mineral waters, **323**, 327, 343, 347, 348, 350, 532-536, 554, 579, 588, 596; inhalation of, 350, 554, 579, 588
- Gastein, 220, 322, 329, 332, 371, 372, **382**, 730, 736
- Gastein (radio-active) baths, 332, 382. See also *Radio-activity in mineral waters*
- 'Gastein (radio-active) baths,' artificial, 332, 351
- Gastein, radio-activity of its springs, 322, 329, 332, 382
- Gastric and gastro-intestinal disorders, chronic, 699. See also under *Stomach* and under *Intestines*, and under *Dyspepsia*
- Gasturi (Corfu), 99
- Gateforth Hall Sanatorium (near Selby), 275
- GATES, E. A.**, 754
- GAULE, J.**, 62
- Gausdal Høifjelds Sanatorium (Norway), 185
- GAUTIER, ARMAND**, 17, 18, 316, 449, 525, 732
- Gavarnio, 176
- Gazost sulphur waters. See *Argelès-Gazost*
- GERHARD, H.**, 629
- GEE, S.**, 620, 715
- GEIKIE, Sir A.**, 44
- Geilnau water, 598
- GEISSÉ, A.**, 754
- GEISSÉ, N.**, 465, 754
- GETTEL, H.**, 57, 322, 328, 330, 395, 406, 752
- Generative organs, diseases of. See *Sexual system*
- Generoso, Monte. See *Monte Generoso*
- Geneva, **153**, 287, 296
- Geneva, Lake of, 150
- Genoa, 291; meteorological means, 236, 291, 293
- GENTH, C.**, 496, 754
- Georg-Victorquelle of Wildungen, 582, 584, 586
- Gérardmer, **182**, 314, 607, 609, 621
- Gerez, Caldas de. See *Caldas-de-Gerez*
- Germania-Brunnen at Dorheim, 598
- Germany, Baltic health resorts of, 127
- Germany, inland health resorts of, 186
- Germany, North Sea health resorts of, 126
- Germes, 574
- Gernrode, 200, 607
- Gernsbach (Black Forest), 195
- Gerolstein and its table water, **189**, 321, 598
- 'Géronstère' spring near Spa, 499
- Gersau (Lake of Lucern), 157, 609
- Gessenay, 166
- GESSNER, CONRAD**, 484, 518
- Geyser, Great, of Iceland, 317
- Geyser spring at Montrond, 461
- Geysers, in various parts of the world, 317
- Geysers, theory of, 317
- Ghent, 294
- Ghezireh Palace Hotel (Cairo), 103
- Giant's Causeway (Ireland), 260
- GIDOTTEAU, A.**, 754
- Gibraltar, 118
- 'Gichtwasser' of Wiesbaden, 350, 416
- Giens sanatorium, near Hyères, 81
- Giessbach Hotel (near Brienz), 157
- Giesshuebl-Sauerbrunn (Giesshuebl-Puchstein), 225, 321, 598, **600**
- 'Gift-brunnen' ('Poison-spring'), explanation of its injurious action, 302
- GIGOT-SUARD, L.**, 754
- GILES, G. M.**, 754
- Gilsland Spa, 268, 504, **548**
- Gimel (Swiss Jura), 153, 160, **519**
- Girgenti, 91
- GIROUS, SALES**, 349
- Glacier water, possible injurious effect of drinking, due to extreme hypotonicity, 302
- Glaciers and snowfields, effect on the atmosphere and climate of neighbouring localities, 51
- Glairine in thermal waters, 326
- Glandore, 258
- Glands, glandular affections. See under *Lymphatic glands*
- Glasgow, 284; loss of sunshine and sunlight owing to smoke and fogs, 284; the surrounding country, 253, 284
- Glatz, health resorts near, 206

- GLATZ, P., 754
 GLAX, J., 10, 97, 235, 754
 Gleichenberg, 222, 468
 Gleisweiler, 193, 622
 Glenbrook (Cork Harbour), 258
 Glengariff, 259
 Glion, above Montreux, 152, 545, 608
 Globenaria water, 302, 597
 Gloggnitz, 222
 Gloucester, 294
 GLOVER, R. M., 754
 GLUCK, 402
 Gluckauf sanatorium (St. Andreasberg), 199
 Glycosuria, 457, 477, 583, 661. See also *Diabetes mellitus*
 Glycosuria, alimentary, possible relationship of oxaluria to, 716
 Gmunden, 219, 435, 607
 Goczalkowitz, 207, 434
 Godalming, 272
 Godesberg, 188, 314, 507
 GODLEE, R. J., 753
 Goepfingen, 599
 Goerbersdorf and its sanatoriums, 205, 627, 679
 Goerz. See *Gorizia*
 Gogmagog Hills (near Cambridge), 295
 Goitre, 731
 Goitre, exophthalmic. See *Graves's disease*
 Gold in sea-water, 328, 449
 GOLDSCHMIDT, 112
 GOLDSTEIN, L., 773
 Gonorrhoeal rheumatism and other 'pseudo-rheumatic' affections of the joints and fasciæ, 655
 Gonten (Appenzell), 159, 519
 Gorbio sanatorium, near Mentone, 84
 GORDON, W., 47, 673, 754
 GORE, W. R., 652
 Goriatchevodsk (Caucasus), 323, 580
 Gorizia (Goerz), 96, 236
 Gorleston-on-Sea, 257
 Gorna-Banja, 231
 Gornegrat Hotel, above Zermatt, 147
 GORSE, DE, 740
 Gossensass, 217, 607
 Gotha, 294
 GOTTSTEIN, A., 61, 754
 GOULD, A. PEARCE, 697
 GOURAUD, A., 740
 Gout and gouty conditions, 76, 360, 373, 490, 547, 583, 651, 653, 663, 708, 714, 717, 730, 738, 739, 741, 742, 743
 Gout and gouty conditions; cases of 'irregular gout' connected with functional derangements of the liver, 708
 Gout and gouty conditions; disadvantages of sea voyages, 76
 Gout and gouty conditions; experiments on 'artificial gout' in birds, 583, 653
 Gout and gouty conditions; experiments on the solvent action of mineral waters on gouty deposits, 653
 Gout and gouty conditions, thermal baths in the diagnosis of, 360
 Gout and gouty conditions, uric acid gravel in regard to, 714
 Gout, 'rheumatic.' See *Rheumatoid arthritis*
 Gouty affections of the skin, 741, 742, 743
 Gouty albuminuria, 490, 547
 Gouty conditions of the ears, 739
 Gouty conditions of the eyes, 738
 Gouty cystitis and gouty urethritis, 717
 Gouty glycosuria, 663
 Gouty neuritis and neuralgia, 373, 730. See also *Sciatica* and *Brachialgia*
 GOWERS, Sir W. R., 357, 372, 547, 576, 658
 Gowlaun spring at Lisdoonvarna, 552
 Grabenbäckerquelle of Gastein, 382
 GRAHAM, 112
 Gradirhäuser, 349, 350
 Grado, 96
 Graefenberg-Freiwaldau, 207, 314
 Graena, 522
 GRAESER, J., 201
 Grampian Mountains, resorts of, 278, 279
 Grampian Sanatorium (Kingussie), 279
 Gran water, 489, 494
 Granada, 288
 Grand Canary, 115, 236
 Grand Chartreuse range, 173
 'Grande Grille' spring of Vichy, 453, 454, 526
 Grange-over-Sands, 252
 Grantown-on-Spey, 278
 Granville (France), 123
 GRANVILLE, A. B., 504, 754
 Grape cures, 621; localities for, 622
 Grasmere, 276
 Grasse, 82, 692
 Gratz, 222, 294, 296
 Grauhof (Harzer Sauerbrunn), 598
 Gravel, urinary. See *Urinary (uric acid) sand and gravel*
 Graves's disease and its incomplete forms, 696, 731; cardiac disorders connected with, 696, 731
 GRAWITZ, 308
 Great Malvern. See *Malvern*
 Great Marlow (Thames), 271
 Great Yarmouth. See *Yarmouth (Norfolk)*
 Greece, physical and psychological methods of treatment in ancient Greek times, 613
 GREENWOOD, M., 41, 754
 Grefsen sanatorium (near Christiania), 185
 Greifswald, 131, 434
 Gremsmühlen, 207
 Grenoble, 172, 294
 Grenzach, 493
 Gréoulx, 173, 572
 Gressoney-la-Trinité, 166
 Gressoney-St.-Jean, 166
 Greville baths, 305, 548
 Greystones, 26
 Gries (Botzen), 215, 622
 Gries (Brenner route), 218

- Griesbach (Black Forest), 196, 418, **511**, 607, 609
 GRIMAUD, A., 366
 Grimm-Alp, Kurhaus, 149
 Grindelwald, 142, **148**, 156, 608
 Grinstead, East. See *East Grinstead*
 GROWDEL, J., *senior*, 712, 754
 Gross-Mueritz, 131
 Gross-Ullersdorf. See *Ullersdorf*
 Grossenlüder ('Hessisches Bitterwasser'), near Salzschlirf, 210, 425
 Grosskarben, springs near, 405, 598
 GROSSMANN, F., 754
 GROSSMANN, J., 342, 755
 Grosswardein, 385
 'Grotta del Cane,' near Naples, 472
 GRUBE, KARL, 10, 342, 583, 755
 Grycp (above Bex), **147**, 154
 GSELL-FELS, TH., 10, 158, 518, 755
 Guagno (Corsica), 574
 Guber spring of Srebrenica, 530
 Gubler spring of Châtel-Guyon, 321, 470
 GUENTZ, J. E., 533, 755
 Guernsey, 123; meteorological means, 280
 Guetsch Hotel, above Lucern, 157
 Guildford, **272**, 295
 GUILLENARD, H., 62
 Güllmer (Teneriffe), 115
 Gulf Stream, **41**, 233, 237, 248
 Gulf Stream, influence of, on the climate of Great Britain and Ireland, 233
 Gulf Stream, influence of, on the climate of the coast of Europe, 41
 GULLY, J. M., 755
 Gurnigel, 149, **562**, 607, 608
 Gurzuf (Taurida), 101
 GUYENOT, P., 303, 327, 491, 747, 751
 Gymnastics, therapeutic use of. See under *Exercises*
 Gypsum (calcium sulphate) waters, 327, 348, 582. See also *Earthy mineral waters*
- HAARLEM, **126**, 504
 'Habsburger Bad.' See *Schinznach*
 Hæmoglobinuria, paroxysmal, 714
 Hæmorrhoids, 534, 697, **707**
 Hagevik sanatorium (near Bergen), 133
 Hague, The, 286
 Hailey Sanatorium (Chiltern Hills), 274
 Hainstein sanatorium (Eisenach), 201
 Hålahult sanatorium (Sweden), 185
 HALDANE, J. S., 58, 62, 698, 755
 HALDANE, W., 422
 Halila Lake (Finland) sanatorium, 132, 232
 HALL, F. DE H., 767
 Hall in Tirol, 218, **435**
 Hall in Upper Austria, 220, **435**, 731
 Hall in Württemberg, 211, **430**
 Halle-on-the-Saale, 429
 Hallein, 435
 Haller Kropfwasser. See *Tassilloquelle*
 Hallstatt, **220**, 607
 HAMAIDE, E., 322, 372
 Hamburg, 286
- HAMEAU, 121
 HAMEL, G., 362
 Hamm, 424
 Hammam Meskoutin, **109**, 581
 Hammam R'irha, **109**, 367, **398**, 631
 Hammam Salahin, near Biskra, 110
 Hampshire, coast of, 244
 Hampstead, 283, 295; Mount Vernon Hospital at, 274, 629; the old 'Hampstead Wells,' 504
 Hands, cold hands and 'bad circulation' in the extremities, **698**, 742, 744
 Hankø sanatorium (Norway), 132
 HANN, JULIUS, 10, 22, 23, 29, 43, 45, 46, 48, 49, 50, 57, 65, 92, 95, 98, 99, 118, 130, 133, 177, 235, 292, 55
 Hannover. See *Hanover*
 Hanover, 286
 Hanse Towns of Germany, 294
 Hapsal (Esthonia) and its mud baths, 131, 339
 HARBURN, J. E., 378, 745
 Harbt Mountains (Rhenish Bavaria), resorts of, 193
 Harkany, 229, **558**
 Harlow Car Sulphur Wells, near Harrogate, 546
 Harlow Hill (Harrogate), 266, 545
 Harmattan wind, 44
 HAROLD, J., 446
 HARPE, E. DE LA, 10, 45, 142, 146, 148, 152, 166, 235, 366, 387, 438, 561, 755
 HARPER, H., 686
 HARPER, J. R., 47
 HARRIS, STANFORD, 116
 Harrogate, 266, 401, 421, 503, 535, **545**, 708, 710, 730; meteorological means, 280
 Harrow, 274, 284, 295
 HARTENBERG, P., 332
 Hartfell Spa (Moffat), 268, 504, 552
 Harth Forest (Emskopf), sanatorium treatment, 202
 Harwich, 257
 Harz Mountains, resorts of the, 199
 Harzburg, **199**, **428**, 607
 Harzer Sauerbrunn, 598
 Haslemere and the neighbouring hills, **272**, 273
 HASSALL, A. H., 244
 Hassocks (near Brighton), 242
 Hastings and meteorological means for, 236, **240**, 280
 HAUFFE, G., 305, 755
 'Hauptstollenquelle' of Baden-Baden, 417
 Haus-Baden (near Badenweiler), 197, 380
 Hauterive waters, near Vichy, 180, **455**
 Hautville (French Jura) and the sanatorium at, 181, 182
 HAVILAND, A., 47, 755
 Hay asthma, 691
 Hay fever, 691
 HAYEM, G., 300, 755
 Hayling Island, 242
 Hayward's Heath, 274
 HEAD, Sir F. B., 755
 Headaches, after influenza, 733

- Headaches, associated with catarrhal conditions of the alimentary canal, 733
- Headaches, associated with chronic disorders of the pelvic viscera, 734
- Headaches, associated with constipation, 733
- Headaches, associated with diminished coagulability of the blood, 348, 401, 583, 735
- Headaches, 'bilious,' 735
- Headaches, chronic or recurrent, 732; possible beneficial effect of mineral waters containing calcium salts in some cases, 348, 401, 583, 735
- Headaches, from chronic intestinal auto-intoxication, 733
- Headaches from mental overwork. See *Mental overwork*
- Headaches, gouty and rheumatic, 733, 736
- Headaches in anemia, 733
- Headaches in chronic disorders of the circulatory system, 735
- Headaches in general debility, 733
- Headaches, migraine, 735; sometimes aggravated at seaside resorts, 55
- Headaches, neurotic, neurasthenic or nervous, 736
- Headaches, toxic and toxæmic forms of, 733, 734, 735
- Health resorts and physical methods of treatment in Ancient Greece, 613
- Health resorts (climatic). See under *Climates* and *Climatotherapy*
- Health resorts, hygienic requirements at, 17, 636
- Health resorts (mineral water). See under *Mineral waters* and *Spa-treatment*
- Health resorts, occasional climatic differences between different portions of the same resort, 636
- Health resorts, selection of. See under *Selection of a health resort*
- Health resorts, selection of rooms and dwellings at, 636, 637
- HEANEY, F. J. C., 252
- Heart affections from acute rheumatism, 654, 693, 694
- Heart affections, possible effect of barium chloride in mineral waters, 347, 401, 547
- Heart and circulatory system, angina pectoris, 64, 695
- Heart and circulatory system, baths and 'Nauheim treatment' for chronic disorders of, 334, 407-410. See also under *Nauheim treatment*
- Heart and circulatory system, chronic diseases of, 64, 334, 347, 358-362, 407-410, 441, 608, 654, 693
- Heart and circulatory system, danger of high altitudes in chronic diseases of, 63, 64, 694, 697
- Heart and circulatory system, localities for an after-cure to spa-treatment in chronic affections of, 608
- Heart and circulatory system, massage and active and passive exercises in chronic affections of, 358-362
- Heart and circulatory system, senile changes, 692, 696; 'cardio-vascular asthma' connected with, 692; danger of sudden ascents to high altitudes by mountain railways, 64
- Heart, dilatation and hypertrophy, 694
- Heart disease with imperfect compensation, 694, 695
- Heart, disorders after influenza and infectious diseases, 694
- Heart disorders in Graves's disease, 696, 731
- Heart, fatty infiltration, 695
- Heart in acute rheumatism, prophylactic value of rest, 654, 693, 694
- Heart, myocardial degeneration, 695
- Heart, myocardial disease from acute rheumatism, 654
- Heart, old compensated valvular defects of rheumatic origin in regard to the question of spa-treatment, 573, 693
- Heart, old compensated valvular defects of rheumatic origin in regard to the selection of climatic resorts, 693
- Heart, palpitation and functional disorders, 696
- Heart, slight stationary valvular defects, 693
- Heart, unimportant cardiac murmurs, 69
- Heatherside Sanatorium (of the Brompton Hospital), 273
- Hebrides Islands, 133
- Hechingen, 556
- HEDLEY, W. S., 303, 304
- Heidelberg, 193, 294, 296, 625
- Heiden (Appenzell), 159, 608, 621
- Heilbrunn (Adelheidsquelle), 213, 433
- Heiligen-Damm (Doberan), 128
- Heiligenblut (Carinthia), 217
- Heiligenschwendi sanatorium, 156
- HEINEMANN, H. N., 756
- HEINRICIUS, G., 362
- HETTLER, M., 408
- HEFTZ, 349, 408
- HELMING, 649
- Helenenquelle of Wildungen, 582, 584, 586
- Helensburgh, 253
- HELFFT, H., 756
- Heligoland, 127
- Helium in mineral waters, 324, 328, 349, 538
- Helium in the atmosphere, 17
- Helium, relation to radium, 17, 324, 328, 349, 538
- Hellebek, 132
- HELLER, R., 41, 756
- HELLMER, 312
- Helouan (Helwan), 103, 367, 581, 634
- Helsingfors, 132
- Helsingör, 132
- Hemicrania. See *Headaches, migraine*
- Hemiplegia from cerebral hæmorrhage or thrombosis, 724
- Hendaye, 121
- Hendon, 284
- Henley (Thames), 271
- Henniez-les-Bains, 599
- HENRICH, F., 416, 417

- HENRIET, 18**
 Hepatic affections. See under *Liver*
HÉRARD DE BESSÉ, 582
 'Hercules' bitter water, 488, 494
 'Hercules' spring, of Hercules-Bad, **436, 557**
 Hercules-Bad, 227, 436, **557**
HÉRICOURT, 685
 Heringsdorf, **129, 130**
 Hermannsbad at Muskau, 523
 Hermannsbad near Lausigk, 523, 530
 Hermsdorf (Riesengebirge), **205, 516**
 Herne Bay, 238
HERRON, G. A., 68
 Herrenalb (Black Forest), 195, 607
 Herrenwies (Black Forest), 195
 Hersfeld, **194**
 Hertenstein (Lake of Lucern), 157
 Hervideros-de-Fuen-Santa, Los, 473
HERXHEIMER, 583
 HERZ, medico-mechanical appliances, 358
 Herzegovina, 229
HENS, KARL, 679
 Hessisches Bitterwasser (Grossenlüder, near Salzschlirf), 210, 425
 Hessleby sanatorium (Sweden), 185
 Heucheloup, 593
 Heustrich, Bad, 156, 562
 Hexentanzplatz (Unter-Harz), the, 200
 Heyst, 125
 High altitudes. See *Climates of high altitude*
 Highgate (London), 283, 295
 Highlands of Scotland, 278
 Hildesheim, 294
 Hill Grove Sanatorium (Mendip Hills), 270
HILL, LEONARD E., 41, 756
HILLIER, A., 18, 628
 Himalayan high altitude resorts, compared, 137
HIMSTEDT, 417
 Hindhead, **272, 273**
 Hinter-Tux, 218
HINTZ, E., 230
 HIPPOCRATES, 613, 631
 Hirsau sanatorium, 195
HIRSCHFELD, J., 756
HIRSCHLER, 734
 'Hirschquelle' of Teinach, 598
HIRZEL, 152
 Hissar (Bulgaria), 230
 Hitzacker-Weinberg, 516
HOAGLAND, H. W., 60, 61
 Hobart Town (Tasmania), journey to, 72
 HOBHOUSE, E., 774
HOBSON, H. O., 581
 Hoehenschwand (Black Forest), 198
HOEDLMOSER, K., 337, 482, 732
 Hoehenstein, Bad, 556
 Hoehlenhain (Hungary). See *Tatra-Hoehlenhain*
 Hoehlenstein (Tirol). See *Landro*
HOERBYE, 580, 751
 Hof-Gastein, 221
 Hofbad. See *Altenburg (Lower Austria)*
 Hofgeismar, 516
HOFFMANN, F. A., 367, 618, 756
HOFMANN, A., 346
 Hog's Back (Surrey), 273
HOHE, A., 756
 Hohenhonnef sanatorium, 188, 627
 Hohenschwangau, 213
 Hohwald (Vosges Mountains), **193, 607, 609**
 'Hoifjelds' and 'Hoilids' climates in Norway, 184
 Holidays and open-air exercise, utility in many dyspeptic cases, 700
 Holidays, disorders of the stomach and intestines at the commencement of, 700
 Holland, coast of, 125
 Hollandia Bron (Haarlem), 505
 Hollingbourn Hill, 273
 Holmbury Hill, 273
 Holmenkollen (near Christiania), 185
 Holmwood (near Dorking), 274
 'Holstein Switzerland,' the, 208
 Holt (near Cromer), 257
 Holy Well (Malvern), 270
 Holyhead, 251
 Holywood (Belfast), 260
 Homburg, Bad, 192, 320, 357, **412, 607, 608, 625, 706, 735**
 Honnef, 188
 'Hôpital' spring of Vichy, 453, 454
 Horley Green chalybeate water, 504
 Hornberg (Black Forest), 196
 Hornsea, 256
 HORROCKS, P., 722
HORTON-SMITH-HARTLEY, P., 275, 773
 Hospenthal, 146
 Hot air and hot vapour baths, general and local, 304, 305, 306, 311, 331, 548, 660. See also *Vapour baths, natural*
 'Hot-well' of Clifton, 270, 379
 Houlgate-Beuzeval, 124
 Hove (Brighton), 242
 Howth, 260
 Hoxton Well, 504
 Hoylake, 252
 Hubertusbad (Thale), 200, **429**
 Huelva, 119
HUFELAND, C. W., 756
HUGGARD, W. R., 10, 63, 64, 318, 756, 774
HUGGELIUS, 518
HUGHES, H., 333, 756, 766
HUGUENIN, G., 590, 756
HUMBOLDT, A. VON, 24, 113
 Humboldt Sanatorium, near Orotava, 114
 Humidity, atmospheric, 16, **32-37, 48, 49, 52**; absolute and relative atmospheric humidity, 33, 35; local conditions influencing, 16, 32, 47, 48, 49, 283; sensibility towards atmospheric humidity ('hygic sensibility'), 27, 52; physiological and pathological effects of atmospheric humidity, 36
 Humidity of the soil and subsoil, as affecting atmospheric humidity, 16, 32, 48, 49; as affecting disease, 47, 48
 Hundseck (Black Forest), 195
 Hungarian bitter waters, 342, 385, **488**; doses of, 495
 Hungary, health resorts of, 226
 Hunstanton, 256

- HUNTER, W., 756
 Hunter's Quay, 253
 Hunyadi Janos water, 320, 342, 488, **494**
 HUSKIE, D., 552
 Huss-Park, near Poprad, 227
 HUTCHINSON, J., 55, 658
 HYDE, J. N., 29, 756
 HYDE, S., 303, 333, 756
 Hydiatry (Hydiatry) or Hydiatrics (Hydiatrics), definition, 299. See also *Hydrotherapy*
 'Hydro,' meaning of the term, 300
 Hydro-electric douche, 303
 Hydro-electrotherapy, 303
 Hydrogen in the atmosphere, 17
 Hydrogen sulphide in mineral water. See *Sulphuretted hydrogen*
 Hydrology, medical, definition, 300
 'Hydropathic' (establishment), meaning of the term, 300
 'Hydropathy,' meaning of the word, 300
 Hydrosulphuric acid in mineral waters. See *Sulphuretted hydrogen*
 Hydrotherapeutics. See *Hydrotherapy*
 Hydrotherapy, **299-315**, 658, 660, 678-680, 701, 737, 719-721
 Hydrotherapy, associated factors in the treatment, 314
 Hydrotherapy, associated with massage, Swedish gymnastics, &c., 314
 Hyrdotherapy, definition, 299
 Hydrotherapy, effects on the nervous and muscular systems, and on the metabolism, 308, 309
 Hydrotherapy, effects on the quality of the circulating blood, 308, 660
 Hydrotherapy, estimation of individual reactive powers, 312
 Hydrotherapy, external use of plain water, 303
 Hydrotherapy, history of, 300
 Hydrotherapy, hydrotherapeutic reaction for cold, 306
 Hydrotherapy, hydrotherapeutic reaction for heat, 309
 Hydrotherapy, indications for treatment, **310-312**, 658, 660, 678-680, 701, 719-721, 737: indications for cold applications, 311; indications for hot applications, 310; in cases of insomnia and defective sleep, 737; in disorders of the female pelvic organs, 719-721; in dyspeptic conditions, 701; in muscular rheumatism, 658; in obesity, 660; in pulmonary tuberculosis, 678-680; precautions and contra-indications, 313
 Hydrotherapy, 'internal hydrotherapeutics,' 302
 Hydrotherapy, localities for hydrotherapeutic treatment, 314
 Hydrotherapy, mechanism of the hydrotherapeutic reactions, 307
 Hydrotherapy, methods of external application, 303
 Hydrotherapy, plain water-drinking, **301**, 302, 370, 602, 603, 715
 Hydrotherapy, precautions and contra-indications, 313
 Hydrotherapy, reactions of the body to cold and heat, 305
 Hydrotherapy, reactions to local applications of cold and heat, 310
 Hydrotherapy, results of cold water applications, 308
 Hydrotherapy, results of hot water applications, 309
 Hydrotherapy, tepid applications, 312
 Hyères, 80
 'Hygiea' establishment at Meran, 314
 Hygienic requirements at health resorts, 17, 636
 'Hygic' sensibility (sensibility towards atmospheric humidity), 27, 52
 Hypertonic mineral waters. See *Mineral waters, hypertonic*
 Hypochondriasis, 725
 'Hypoplastic' debility, 642
 Hypotonic mineral waters. See *Mineral waters, hypotonic*
 Hypotonicity of some waters, as possibly accounting for their injurious action, 302
 Hysteria, 725
 Hythe, 240
 ICELAND, 133
 Icterus. See *Jaundice*
 Igls (near Innsbruck), 218
 Igmandi bitter water (Lord Roberts spring), 488
 Ilanz, 155
 Ilfracombe, 249
 Ilidze, 229, **558**
 Ilkley Wells, **276**, 314; water of, 602
 Ilmenau (hydrotherapy), **201**, 314, 607
 Ilseburg, **199**, 607
 Imnau, **196**, **510**
 Impotence, 718
 India, voyages to, 72
 Indian resorts of high altitude, compared, 137
 Indications, therapeutic; indications for treatment by climates, mineral waters, and health resorts, 611-744. See also under *Climatotherapy*, *Spa-treatment*, and *Hydrotherapy*, and under the names of the various diseases and morbid conditions
 Indifferent thermal waters. See *Simple thermal waters*
 Inellan (near Dunoon), 253
 Infectious diseases, acute, convalescence from. See *Convalescence*
 Influenza and other infectious diseases, cardiac disorders after, 694
 Inhalation of gases from mineral waters, 350; inhalation of nitrogen, 350, 579, 588; inhalation of sulphuretted hydrogen, 350, 554. See also *Sulphurous vapour baths, natural*, and *Inhalation, pulverisation, and sprays of mineral waters*
 Inhalation, pulverisation and sprays of mineral waters, **349**, 464, 528, 532, 537, 539, 543, 554, 572, 574, 579, 588, 604, 689

- Inland climates. See *Climates, inland*
 Innerleithen, 277, **422**
 Innichen and Wildbad-Innichen, 217, **556**
 Innsbruck, **218**, 294, 608
 Inowrazlaw, 429
 Inselbad, near Lippspringe, 209, **588**
 Insolation. See under *Sunshine*
 Insomnia. See *Sleep, deficient*
 Insular climates. See *Climates, insular*
 Interlaken, **156**, 609, 622
 'Intermediate stations' to high altitude resorts, 141, 503
 Intestinal auto-intoxication, 704, 705; connection with chronic constipation and catarrhal conditions, 733
 'Intestinal lithiasis,' 706
 Intestines, chronic catarrh and chronic disorders of, 699-707. See also under *Colitis and Constipation*.
 Intestines, influence of the osmotic pressure of mineral waters on, 488
 Inversnaid, 277
 Iodbad Darkau. See *Darkau, Bad*.
 Iodides in mineral waters, 346, 401
 'Iodine baths,' 315
 Iodine in mineral waters, 346, 401; in organic combinations, 346, 466
 Iodine in sea-air, 18, 449, 732
 Iodine in sea-water, 449
 Ionian Islands, 98
 Ionisation. See *Ions, theory of*
 Ions, theory of, in regard to mineral waters, 318
 Ireland, inland health resorts, 279
 Ireland, seaside resorts, 258
 Irish-Roman baths. See *Roman baths*
 Irish Royal National Hospital for Consumption (County Wicklow), 261
 Iron baths, 333, 497. See also *Sulphate of iron baths and Gaseous (effervescent) baths*
 Iron, various salts of, in mineral waters, 323, 326, 345, 528; effect of iron salts in mineral waters, 345. See also *Chalybeate waters*
 Iron waters. See *Chalybeate waters*
 'Irritable weakness,' 567, 644, 728. See also under *Neurasthenia*
 Isabella, La. See *Sucedon*
 Ischia, **91**, 340, 397, 447, **472**
 Ischl, **219**, 337, 400, **434**, 607
 Iseltwald (Lake of Brienz), 157
 Isenfluh (Switzerland), 149
 Iso, lake of, 163
 Isobars or Isobaric lines, 38, 39
 Isocheimical lines, 24
 Isothermal lines, 24
 Isothermal lines, 24
 Isotherms, monthly, seasonal, and annual, 24
 Isotonic mineral waters. See *Mineral waters, isotonic*
 Isotonicity of mineral waters, advantage of, in regard to sprays and douches for the nose, naso-pharynx, &c., 349; advantage of the addition of salt to very hypotonic waters in some cases, 302, 349
 Italy, inland health resorts, 166
 Italy, meteorological means for Italian towns compared, 291
 Italy, the Adriatic coast, Venice, 94
 Italy, the coast of Southern Italy, 89
 Italy, the Eastern Riviera, 87
 Italy, the Italian portion of the Western Riviera, 85
 Italy, the North Italian Lakes, 161; the health resorts of, compared, 165, 166
 Ivanda water, 489, 494
 Ivonicz (Galicia), 227, **436**
 JACKSON, 627
 JACOB, J., 334, 756
 JACOB, P., 756
 JACORY, F., 680
 Jagstfeld. See *Jaxtfeld*
 JAMES, C., 756
 JAMES, P., 757
 JANTCOT, J., 593, 757
 Japan, voyages to, 70
 JAQUET, A., 60, 61, 62, 757
 JARUNTOWSKY, A. VON, 757
 Jaundice, chronic catarrhal, 707
 Jaundice, connected with cholelithiasis. See *Cholelithiasis*
 JAWORSKI, W., 351
 Jaxtfeld, 211, **430**
 Jeleznovodsk (Caucasus), 232, 522
 Jelly Fishes, therapeutic use at Scandinavian resorts for counter-irritation to the skin, 580, 581
 Jenbach, 218
 JEPHSON, H., 492
 Jersey, 123, 280 (meteorological means)
 JESSEN, F., 731, 757, 774
 Johannis-Brunnen of Gleichenberg, 468
 Johannis table water, 190, **598**
 Johannisbad (Bohemia), 205, **384**
 Johannisbrunn (Austrian Silesia), 207, **513**
 JOHNSON, J. R., 669
 JOHNSTON-LAVIS, H. J., 90, 757
 Joints, chronic affections of the, 311, 357, 441, 566, 576, **654-658**; in cases of muscular rheumatism, 658; of traumatic origin, 311, 441, 566, 576, **657**. In regard to tuberculous cases see *Tuberculosis, articular and osseous*
 JOLLY, 62
 Jonas spring at Bourbon-l'Archambault, 439
 JONES, E. LLOYD, 640
 JONES, W. BLACK, 422, 757
 JONQUIERE, G., 562, 757
 Joppa (near Edinburgh), 284
 JOURDANET, 58
 Journey to health resorts, precautions in regard to, 354, 616, 617, **634**; special danger in cardiac disorders when compensation is commencing to fail, 407, 409, 694
 Jugenheim, 193
 Juist, 126
 JULIA DE ROIG, H., 536
 Julier route (Switzerland), resorts of, 145

Juliusshall (Harzburg), 199, **428**
 Jungfrau Hotel (Wengernalp), 149
 Jura Mountains, French, 181
 Jura Mountains, Swiss, 150, 153, 160
 Just, G., 418, 768
 Juventa water, 516

KAHLENBERG (near Vienna), 221
 Kainzenbad, 213, **555**, 608
 Kaiser Wilhelm Bad (Driburg), 507
 Kaiserbad (Buda-Pest), 228, 385
 'Kaiserin Friedrich' sanatorium for children at Norderney, 127
 KALMANN, A. J., 329, 757
 Kaltenbach at Ischl (hydrotherapy), 314
 Kaltenbrunn, near Voelsau (hydrotherapy), 314
 Kaltenleutgeben (hydrotherapy), 221, 314
 Kammer (Attersee), 220
 Kanitzerbad. See *Kainzenbad*
 Kaposi's disease, 29, 742
 KARCHER, J., 60, 751
 Karersee Hotel, **217**, 606
 Karlovo (Bulgaria), 230
 Karlsbad (Bohemia), 223, 321, 322, 356, 367, 368, **475**, 609, 615, 664, 708, 710, 743; radio-activity of its springs compared, 418
 Karlsbad, the, at Mergentheim, 493
 Karlsbrunn, 516
 Karlsruhe, 286, 287, 294
 'Karlsprudel' at Biskirchen, 598
 Karras, Maria Theresa spring, 580
 Karst, the, district near Abbazia, 97
 Kassel. See *Cassel*
 Katrine, Loch, hotel on, 277
 KEHR, HANS, 710, 757
 KEITH, SKEENE, 389
 Kellberg, 516
 KELLER, H., 400, 437, 757
 Kelling sanatorium (Holt, near Cromer), 257
 KELLOGG, J. H., 301, 304, 312, 757
 KELYNACK, T. N., 626, 628, 757
 Kemmern, 131, 580
 Kemp Town (Brighton), 242
 Kenmare Bay (Ireland), 259
 KENNEDY, H., 758
 Kent, coast resorts of, 238
 Kephir, treatment with, 620
 Kephissia (near Athens), 292
 KERR, J. G. D., 304, 758
 Kerry, resorts of, 259
 Kertch (Crimea), 100
 Kesselfall-Alpenhaus, 220
 Kestenholz (Alsace), 433
 Keswick, 276
 Khamseen wind, 44
 Kidneys, calculus of, 716
 Kidneys, diseases of, 712; chronic nephritis, 712; chronic interstitial nephritis, 713; slight forms of nephritis, 457, 713; common salt in mineral waters in regard to the treatment of renal dropsy, 713. See also under *Albuminuria*
 Kiedrich, 425

Kiefer-Fischer apparatus for artificial gaseous baths, 438
 Kiel, 128
 Kienbergklamm, 219
 KIESOW, 58
 Kilkee, 259
 Kilkeel, 260
 Killarney, 259, 280 (meteorological means)
 Killiney, 261
 Kilrush, 259
 'Kinder-Brunnen' of Salzschlirf, 425
 King Arthur's Spring, near Carnarvon, 504
 King Edward VII. Sanatorium (near Midhurst), 273
 KING, PRESTON, 758
 King's Well at Bath, 376, 582
 Kingston-on-Thames, 271
 Kingstown (Dublin Bay), 260
 Kingussie, 278
 Kinloch-Rannoch, 278
 KIONKA, H., 348, 583, 653, 715, 758
 KIRCHHOFF, 323
 KIRCHNER, M., 102
 KIRKBY, W., 351
 Kirkmichael Sanatorium, 278
 Kirn (near Dunoon), 253
 KISCH, E. H., 10, 320, 338, 480, 758
 Kislovodsk (Caucasus), 232, **595**
 Kissingen, 211, 320, 348, 349, 368, 401, **414**, 609, 625, 706, 735
 Kissingen 'bitter water,' 350, 414
 'Kissingen Well' of Harrogate, 546
 Kitzbühel, 219
 Klampenborg, 132
 Klausenquelle of Gleichenberg, 468
 KLEIN, C., 758
 KLINEK, U., 436, 685, 758
 Klobenstein (near Botzen), 215
 Klosterle water, 598
 Klosters, 145
 KNAUR, 384
 Kniebis Mountain resorts, 195, 196, **510**, **511**
 Knocke (Belgium), 125
 Knockin chalybeate water, 504
 KNOPF, S. A., 628, 758
 'Kochbrunnen' of Burtseid, 543
 'Kochbrunnen' of Wiesbaden, 320, 322, 416; radio-activity of, 329, 341
 Kochel (Bavarian Alps), 213
 KOEHLER, F., 628
 KOENIG, 621
 Koenig-Otto Bad, 512
 Koenig-Otto-Bad (Fichtelgebirge), 203
 KOENIGER, K., 164, 166
 Koenigsberg, 294
 Koenigsborn, 424
 Koenigsbrunn (Saxon Switzerland), hydrotherapy at, 314
 Koenigsdorff-Jastrzemb, 207, **434**
 'Koenigsquelle' at Wildungen, 584
 Koenigssee (Bavarian Alps), 213
 Koenigstein (Taunus), **191**, 314, 607, 609
 Koenigswart, Bad, 225, 514
 Koenigswinter, 188
 KOEPPE, H., 60, 302, 773
 Koesen, 429

- Koestritz, and sand-baths at, 202, 340, **426**
 Kohlgrub, Bad, 213, **513**
 Kohlhof (Heidelberg), 198
 Kolberg, **129**, 131, **429**
 Konstanz. See *Constance*
 Konstanzerhof sanatorium, 160
 KORANYI, A. von, 321
 Koritnica, 228, **515**
 Korytnicza. See *Koritnica*
 KOTKEWITZ, A. von, 319, 320, 758
 Koumiss, treatment with, 620
 Kovaszna, 469
 'Kraenchen' spring at Ems, 464
 Krankenheil-Toelz, 213, **603**
 Kranz, 130
 Krapina-Toplitz, 229, **385**
 KRAUS, F., 475, 758
 KRAUS, J., 758
 Kreuth, **213**, **438**, 609
 Kreuzbrunnen of Marienbad, 322, 479, 480, 495
 Kreuznach, 189, 322, 349, **410**, 526, 719, 721, 722
 Krieglach, 222
 Kronberg (Cronberg), 191
 Krondorf waters (near Karlsbad), 225, 598
 KRONECKER, H., 341, 362, 758
 'Kronenquelle' of Obersalzbrunn, 458
 Kronthal springs, 192, 598
 Krummhübel, 205
 Krynica, 227, **514**, 589
 Krypton in the atmosphere, 17
 Kudowa (Prussian Silesia). See *Cudowa*
 KUEMMEL, 321
 Kufstein, 219
 Kujazevo (Bulgaria), 231
 KUNTZE, M., 165, 758
- LA BAUCHE. See *Banche, La*
 La Baule. See *Baule, La*
 La Bocca (near Cannes). See *Bocca, La*
 La Bourboule. See *Bourboule, La*
 La Cava. See *Cava dei Tirreni, La*
 La Comballaz. See *Combballaz, La*
 La Condamine (Monaco). See *Condamine, La*
 La Foce (Corsica). See *Foce, La*
 La Mouillère (Besançon). See *Mouillère, La*
 La Preste. See *Preste, La*
 La Raillère spring. See *Raillère, La*
 La Tremblade. See *Tremblade, La*
 La Turbie (near Monaco). See *Turbie, La*
 Laacher See, 189
 Labassère water (Bagnères-de-Bigorre), 176, 567, **591**
 LABAT, A., 10, 349, 448, 758
 LABORDE, A., 321, 328, 372, 382, 388
 Lac de Champex (Switzerland). See *Champex, Lac de*
 Lac Noir. See *Schwarzsee*
 Lacul-Sarat, 230
 Ladis, 218, **557**
 Lady Cromartie Well of Strathpeffer, 551
 Lady Ida Well chalybeate water (Shropshire), 504
- Laengenfeld (Oetzthal), 218, **557**
 Laguna (Teneriffe), 115
 Lahinch, 259
 LAISSUN, C., 758
 LAJAUNIE, H., 740
 Lake climates. See *Climates, inland, of large lakes*
 Lake climates, North Italian lakes, 161, 165
 Lake climates, Swiss lake resorts, 150, 157, 158, 159
 Lake District of England, 276
 Lake District of Killarney, 259
 LAKE, R., 739
 Lake Vyrnwy Hotel (Wales). See *Vyrnwy Hotel*
 Lakes of Scotland, 277
 LALESQUE, F., 451, 758
 Lamalou-les-Bains, 180, 356, **519**, 526, 724, 728
 LAMARQUE, H., 174, 175
 Lamotte-Beuvron, 'Sanatorium des Pins,' 181
 Lamotte-les-Bains, 173, **443**
 Lamscheid, the 'Lamscheider Stahlbrunnen,' 507
 Landeck (Inn Valley), 218
 Landeck, Bad (Prussian Silesia), 207, **381**, 556
 Landro (Tirol), 217
 LANE, A., 333
 Langenau, Bad. See *Niederlangenau*
 Langenbruck (Swiss Jura), 160
 Langenbrücken (Baden), 555
 LANGENHAGEN, M. DE, 706, 759
 Langensulza, 555
 Langenschwalbach (Bad Schwalbach), 191, 380, **500**, 607
 Langwies, 145
 Lanjaron, 522
 Lanzo d'Intelvi, 163
 LAQUEY, B., 621, 759
 LARAUZA, A., 393, 759
 Largo, 255
 Largs, 253
 Larivière-sous-Aigremont (near Bourbonne-les-Bains), 412, 593
 LARKING, A. E., 759
 Larynx, chronic laryngitis, 527, 539, **687**
 Larynx, tuberculosis of, influence of climate in, 672; significance in regard to the climatic treatment of pulmonary tuberculosis, 672
 Las Furnas valley springs (San Miguel), 116
 Las Palmas (Grand Canary), **115**, 236
 LASSAR, O., 774
 LATHAM, A. C., 628, 759
 LATHAM, P. W., 759
 Latitude, influence of, on climate. See *Climate, influence of altitude and latitude on*
 Laubbach (near Coblenz), **188**, 314
 Lauchstädt, 516
 Laufenburg, 438
 Laurvik, 132, **581**
 Lausanne, **152**, 296
 Lausigk, Bad, **523**, 530

- LAUSSEDAT, 759
 Lauterbach (Island of Ruegen), 129
 Lauterberg (Harz Mountains), hydro-therapy at, 314
 Lauterbrunnen, 156
 Lauvaassen Hoifjelds-Sanatorium (Norway), 185
 LAUZUN-BROWN, W., 133
 Lavage of the stomach, of the large intestine, or of the urinary bladder, mineral waters employed for, 331
 LAVARENNE, E. DE, 740, 759
 Lavarone, 216
 Lavey-les-Bains, 154, 340, **560**
 Lay-St. Christophe sanatorium (France), 183
 LAZARUS-BARLOW, W. S., 123, 246, 773
 Leamington, 268, 294, 295, **492**, 495
 Le Boulou. See *Boulou, Le*
 LE BRET, E., 751
 Le Croisic. See *Croisic, Le*
 L'Etivaz. See *Etivaz, L'*
 Le Montet (Cransac). See *Montet, Le*
 Le Prese. See *Prese, Le*
 Le Puy. See *Puy, Le*
 Le Toquet. See *Toquet, Le*
 Le Tréport. See *Tréport-Mers, Le*
 Le Vernet. See *Vernet-les-Bains*
 Lebanon mountains, 101
 LEBER, H., 360
 LEDERT, 621
 Ledesma, 170, **579**
 LEDUC, S., 332, 658
 LEECH, D. J., 759, 773
 Leeds Sanatorium (Gateforth Hall), near Selby, 275
 Lee-on-Sea (Devon), 249
 LEFORT, J., 751
 Leghorn. See *Livorno*
 LEGRAND-HERMANN, 106
 LEHMANN, L., 423, 759
 LEHMANN, S. E., 759
 LEICHTENSTERN, O., 759
 'Leiningcr Wasser.' See *Lamscheid*
 Leipzig, 286
 LEITH, R. F. C., 759
 Leith Hill, neighbourhood of, 273
 Leixlip Spa (near Dublin), 279, 553
 Lemau, Lake. See *Geneva, Lake of*
 Lenk, 149, **561**
 Lenzer-Heide (Switzerland), 145
 LEO, H., 680
 LEON, G. A., 641
 Leon island (Cadiz), 119
 LÉON-PETIT, E. P., 282, 684, 759
 LEROUX, C., 759
 LERSCH, B. M., 449, 759
 Les Avants. See *Avants, Les*
 Les Escaldas. See *Escaldas, Les*
 Les Ormonts valley. See *Ormont-dessus and Ormont-dessous*
 Les Planches (Switzerland). See *Planches, Les*
 Les Plans (Switzerland). See *Plans-de-Frenière*
 Les Rasses (Switzerland). See *Rasses, Les*
 LESIEUR, C., 749
 Lesina island, 98
 Leucorrhœa, 483, 499, 501, 567, **720**
 LEUDET, L., 760
 Leukerbad. See *Loèche-les-Bains*
 LEUSSER, J., 416, 760
 LEVA, J., 760
 Levico, 216, 321, 524, **528**; 'strong' Levico water, 528; 'weak' Levico water, 529; 'weak' Levico water, as modified for exportation, 529
 Leyden (Holland), 294
 LEYDEN, E. VON, 308
 Leysin (Switzerland), and sanatorium treatment at, 141, 154, 627
 Liburnian 'Riviera,' 97
 Lidford, 269
 Lido island, near Venice. 95
 Liebenstein, 202, 314, **509**, 607, 609
 Liebenzell, 195, **381**
 LIEBERMEISTER, K., 308
 LIEBIG, G. VON, 41, 212, 760
 LIEBREICH, O., 302, 496, 497, 507, 760
 Lieberda, 205, 514
 Liège, 294
 Lierganes, 579
 LIERNBERGER, O., 529
 Liestal (near Basel), 160
 LIEVEN, A., 760
 Life at spas. See *Spa-treatment, daily life at spas*
 Light, 27-31. See also under *Sunlight and Sunshine*
 Light, diseases influenced by, 27, 29, 742
 Light, influence of 'chemical' (ultra-violet) rays, 28, 57, 742
 Light, influence of red light, 27
 Light, loss of sunshine and sunlight owing to smoke and fogs in London and large towns, 19, 30, 31, 48, 283, 284
 Lightning, 31
 LILIENTSTEIN, 649
 'Timans' (brine lakes) of Russia, 100, **337**
 Lime (carbonate of) in waters. See under *Calcium carbonate*
 Limpley Stoke (hydrotherapy), 264, 314
 Limpsfield (Surrey), 274
 Lincoln, 294
 Linda-Pausa, 524, 530
 Lindau (Lake of Constance), 159
 LINDEMANN, E., 760
 LINDEN, D. W., 504, 549
 'Lindenbrunnen' of Schwalbach, 501, 600
 Lindenfels, 193
 Lindheim (Livonia) sanatorium, 132
 LINDHAY, J. A., 135, 259, 760
 Linford Sanatorium (New Forest), 271
 Ling's exercises in connection with treatment at health resorts, 357, 361, 408
 LINN, T., 760
 LINNÆUS, 622
 Lipetsk (Russia), 232, 337, 523
 Liphook, 274
 Lipik, 229, **469**
 LIPPERT, C., 221
 Lipp Springs, 209, 350, 582, **588**, 678
 Lisbon, 119

- Lisdoonvarna, 279, 504, **552**
 LISHMANN, F., 113, 114
 Liss (Hampshire), 274
 Lissa (island of), 98
 Lithium salts in mineral waters, 323, 347
 Littlehampton, 242
 Littlestone-on-Sea, 240
 LIVEING, G. D., 17
 Liver, chronic affections of the, 477, **707-711**; congestion, 707; disorders connected with malaria and long residence in hot climates, 477, **708**; functional disorders, 477, **708**; use of hill-climbing and respiratory exercises in hepatic disorders, 709. See also under *Jaundice*, *Cholelithiasis*, and *Cholagogue action of mineral waters*
 Liverpool Sanatorium in Delanere Forest, 275
 Livorno (Leghorn), 88
 Llanberis, **276**, 610
 Llandrindod Wells, 266, 421, **548**, 708, 710
 Llandudno, **251**; 280 (meteorological means)
 Llangammarch Wells, 267, 401, **421**; meteorological means, 280
 Llangollen, **277**, 610
 Llanrwst, 277
 Llanwrtyd Wells, 267, **550**
 Lobenstein, **202**, 516
 Locarno, **161**, 165, 166, 236, 609
 LOCKE, JOHN, 504
 LOCKYER, SIR NORMAN, 324
 Loèche-les-Bains, 148, 371, **386**, 582, 583, 590, 742
 'Loèche' prolonged tepid baths, 387, 742.
 See also *Baths, prolonged tepid*
 Loëches (La Margarita), 489
 LOETSCHER, H., 320, 760
 LOEWY, A., 58, 60, 760, 773
 Loire, places on the, 294
 Loka (Sweden), and mud baths of, 132, 185, 339
 LOMBARD, H. C., 760
 Lomond, Loch, resorts on, 277
 London, 282; meteorological means, 236, 283, 293; its 'black fogs' and loss of sunshine and sunlight owing to smoke and fogs, 283; suburbs and neighbouring country of, 271, 272, 273, 274, 283, 284, 295; mineral waters formerly used in London or its neighbourhood, 489, 504
 LONDON, B., 760
 London Open-air Sanatorium (Pinewood), 274
 LONGSTAFF, T. G., 58, 760
 Lons-le-Saunier, 181, **443**
 LORAND, A., 652
 'Lord Roberts spring.' See *Igmandi bitter water*
 LORINCZ, H., 705
 Los Hervideros. See *Hervideros*
 Lostorf, 563
 Loudenvielle, 574
 Louèche-les-Bains. See *Loèche-les-Bains*
 Lourdes, 295
 Louvain, 294
 Lovrana (Abbazia), 97
 Lowestoft, 257
 Lucan (near Dublin), 279, 552
 LUCAS, R. C., 333
 Lucca, Bagni di, 167, 168, 582, **594**
 Lucern, 157, 287, 609
 Lucern, Lake of, 157
 Luchon, Bagnères de, 175, 349, 536, **537**, 740
 LUCIEN-GRAUX, 321, 349, 350, 488, 760
 Lucius spring of Tarasp, 320, 484, 495
 Lueski, 517
 LUDWIG, E., 337, 482, 494
 Ludwigsbad (Wipfeld), 210, **555**
 Ludwigsbrunnen, near Grosskarben, 405, 598
 Ludwigsbrunnen, near Nauheim, 192, 598
 Luebeck, 294
 LUFF, A. P., 760
 'Luftkur Sanatorium' (Portbury), 270
 Lugano, **162**, 165, 166, 236, 609
 Lugano, Lago di, 162
 Luhatschowitz, Bad, 225, 468, 715
 Luino (Lago Maggiore), 162
 'Luisenbäder' of Franzensbad, 481, 483
 'Luisenheim' Sanatorium (Black Forest), 197
 Lumbago, 310, 372, **658**. See also under *Fibrositis*
 Lungs, chronic non-tuberculous affections of the lungs and respiratory organs, 688-690. See also under *Bronchitis, chronic*, *Emphysema of the lungs*, and *Asthma*
 Lungs, effects of residence at high altitudes on, 59
 Lungs, tuberculosis of. See *Tuberculosis, pulmonary*
 Lussin, Island of, 98
 Lussin-Grande, 98
 Lussin-Piccolo, 98
 Luxembourg, **184**, 294
 Luxeuil-les-Bains, 182, **390**, 521
 Luxor, 104
 Luz (near Saint-Sauveur), 176, 566, 567
 Lyme Regis, 246
 Lymphatic glands, serofulous and tuberculous, 681, 683. See also *Scrofula and serofulous affections*
 Lyndhurst (New Forest), 271
 Lynmouth, 249
 Lynton, 249
 Lyons, 288
 Lysekil (Sweden), 132, 339
 Lyster sanatorium (near Bergen), 185
 Lytham, 252
 MACALLUM, A. B., 346
 Macduff (near Banff), 254
 MACCORMAC, HENRY, 18, 627, 761
 MACGAHAN, C. F., 669
 MACHE, H., 321, 328, 382, 761
 MACLAREN, 677
 MACLEOD (Ben Rhydding), 276
 MACLEOD, J. J. R., 41, 756
 McLURE, H., 67
 Macolin (above Lake of Bienna), **180**, 608

- MACPHERSON, J., 10, 504, 577, 761
 Macugnaga, 166, 608
 MADDEN, T. M., 721, 761
 Madeira, 112, 236
 Madeira, voyage to, 69
 Maderaner Thal, 149
 Madero (Lago di Garda), 164
 Madonna di Campiglio. See *Campiglio*
 Madrid, 288
 Magdeleine spring at Vals-les-Bains, 456, 457
 MAGELSSSEN, A., 184
 MAGER, W., 41, 756
 Maggiore, Lago, 161
 Magglingen. See *Macolin*
 Magnesia Well of Harrogate, 546, 547
 Magnesium bicarbonate in mineral waters, comparative table, 582
 Magnesium sulphate in mineral waters, 326, 345, 488, 494; comparative table of amounts present in different waters, 494, 495; effects of, 345, 488; 'bitter waters,' 326, 488, 489
 MAQUIRE, R., 773
 Maidenhead (Thames), 271
 Mainz, 294
 Majorca, 94
 Malaga, 118, 236
 Malahide, 260
 Malaria and malarial disorders, 47, 477, 525, 608, **663**, 708, 730; relation to drainage of the soil and climate, 47, 664; liver disorders connected with, 477, 664, 708; malarial neuralgia, 730; malarial cachexia, 525, 664; localities for an after-cure to spa-treatment in malarial cases, 608
 Malavella, Caldas de. See *Caldas-de-Malavella*
 Malberg (Ems), 190
 Mallow, 279, 379
 Malmedy (Rhenish Prussia), 516
 Malo-les-Bains (Dunkirk), 125
 Malou, La (France). See *Lamau*
 Maloggia. See *Maloja*
 Maloja, 142, **143**, 608
 Malta, 94
 Malvern, **270**, 314, **420**; water of the Malvern springs, 420, 599, 602
 Mammern (hydrotherapy), 159, 314
 Man, Isle of, resorts of, 253
 Manchester Sanatorium in Delamere Forest, 275
 Manganese salts in mineral waters, 346
 Mantega Sanatorium (Nice), 83
 Mapother, E. D., 552, 553, 761
 Marazion, 247
 Marbach, Schloss (sanatorium), 160
 Marburg, 296
 MARBURG, O., 761
 MARC, W., 585, 768
 MARCET, W., 761
 Marcols, 461
 MARCUS, S., 761
 MARCUSE, J., 305, 761
 Marecotte, 154
 Margarethen-Insel and Margarethenbad (Buda-Pest), 228, 385
 Margarita, La (Loëches), 489
 Margate, **238**, 280 (meteorological means)
 Maria Theresa spring at Karras, 580
 Mariakerke, 125
 MARIE, PIERRE, 657
 Marienbad, 224, 321, 322, 337, 368, **479**, 514, 609
 Marienberg, at Boppard (hydrotherapy), 188, 314
 Marienlyst (Helsingör), 132
 Marienquelle of Bad-Elster, 485
 Marilla (Hungary), **228**, 314
 Marine climates. See *Climates, marine*
 Marine mud-baths. See *Mud-baths, marine*
 Marine seaside sanatoriums for scrofulous and weakly children, 630
 Marlborough, 270
 Marlioz (near Aix-les-Bains), 171, **543**, 688
 Marlow (Thames). See *Great Marlow*
 Marmolejo, 461
 MARRIOTT, W., 10, 31, 39, 98, 761
 Marsh gas in mineral waters, 324
 Marsh gas in the atmosphere, 17
 Marstrand, 132
 Martigny-les-Bains, 182, 321, **593**
 MARTIN, ALFRED, 761
 Massage at health resorts, 314, 339, **356**, 360, 580, 581, 601, 614; with hydrotherapy, 314; massage with mud and in connection with mud baths, 339, 580, 581, 601
 Massage, uses of, **356**, **360**, 361, 735; in some forms of chronic headache, 735; in affections of the heart and circulatory system, 361; effects on the quality of the circulating blood, 308, 660
 Massonat water at Aix-les-Bains, 543, 599
 Matlock, 264, 314, **378**
 MATTHEW, M., 300, 761
 Mattigbad, 517
 'Mauhourat' spring at Caunterets, 539
 Max-Brannen of Kissingen, 414
 MAX, W. PAGE, 104, 105, 761
 Mayence. See *Mainz*
 Mayens-de-Sion, 147
 MAXER, 60
 MAYER, G. F. W., 773
 MAYER, JACQUES, 477, 710, 761
 MAYER, MAX, 400, 761
 MAYER, PAUL, 716
 Mayfield (Sussex), 274
 'Maynard' spring, near Bourbonne-les-Bains, 442, 593
 MAYO, H., 761
 Meat diet in regard to tuberculosis and scrofulous conditions, **683-686**; experiments with meat diet in animals, 652, 653, 685
 Mechanotherapy, in connection with treatment at health resorts, 357, 410, 358, 614; varieties of medico-mechanical apparatus, 358, 410
 Medical supervision at health resorts, 363, **365**, 617, **623**, 625, 662, 680, 681; in cases of pulmonary tuberculosis, 680, 681. See also *Sanatorium treatment*

- Medicated baths. See *Baths, medicated* and *Baths of mineral waters (artificial)*
- Medicated waters. See *Mineral waters, artificial*, and *Mineral waters, medicated*
- 'Medication' of natural mineral waters for therapeutic purposes, 350, 351, 547, 597, 695
- Medico-mechanical appliances. See *Mechanotherapy*
- Mediterranean coast, 78
- Mediterranean sea-water, composition and temperature of, 78, 83, 130, 449, 451
- Mediterranean voyages, season for, 72
- Medstead (Hampshire), 274
- Mehadia. See *Hercules-Bad*
- Meinberg, 209, 337, 554
- Meissen, 294
- MEISSEN, F., 61, 188, 628, 761, 762
- Melcombe Regis (Weymouth), 245
- Melksham, 493, 503
- MELLAND, BRIAN, 115
- Meltscher Bad. See *Johannisbrunn*
- Memel, meteorological means, 130
- Mena House Hotel, near Cairo, 103
- Menaggio, 163, 609
- Mendel Pass (Tirol), 217
- MENDINI, 289
- Mendip Hills, 270; 'Nordrach-upon-Mendip' Sanatorium, 270; Mendip Hills Sanatorium (Hill Grove), 270
- MÉNEAU, J., 762
- Menopause. See *Climacteric period in women*
- Menorrhagia, 719; associated with fibroid tumours of the uterus, 412, 419, 444, 719, 722
- Menstruation, disorders of, 719; deficient, 719; excessive, 719, 722; painful, 720; influence of climate on, 719, 723
- Mental depression, 726, 727
- Mental factor in regard to the management of senility and premature senility, 667
- Mental factor in the treatment of diabetes mellitus, 662
- Mental factor in treatment at health resorts, 354, 613, 614
- Mental overwork, 355, 726
- Mental rest and recreation, importance of, 281, 613. See also *Rest and recreation in connection with treatment at health resorts, &c.*
- Menton (Mentone), 84; Cap Martin Hotel near, 84; Gorbio Sanatorium near, 84
- Meran, 214, 236, 358, 609, 614, 622
- MERCIER, A., 60, 762
- Mérens, 574
- Mergentheim, 493
- MERING, J. F. von, 342, 702
- Meritchlery (Bulgaria), 230
- MERKLEN, P., 408
- Merrow (near Guildford), 274
- 'Mesdames' spring (Vichy), 454, 455
- Mesnalién Sanatorium (Norway), 185
- Meta, near Sorrento, 90
- Metabolism, disorders of, 638; sanatorium treatment at mineral water resorts, 416; effects of residence at high altitudes on the metabolism, 59, 60. See also *Gout and gouty conditions*, *Obesity*, and *Diabetes mellitus*
- Metallic poisoning, chronic, 650
- MECHNIKOFF, F., 620, 621
- Meteorology. See under *Climate* and *Climates*
- Methane. See *Marsh gas*
- Metritis, chronic, 721. See also under *Uterus*
- Meudon (near Paris), 287
- MEYER-ARENS, C., 138, 762
- MEYERHOFFER, W., 302, 328, 449
- Micro-organisms in thermal waters, 326
- Middelkerke, 125
- Middlesborough brine, 255, 421, 547
- Middlewich (Cheshire), 265, 421
- Midhurst, 274; King Edward VII. Sanatorium near, 273, 629
- Miers, 491
- MIESCHER, F., 60, 61, 751, 762
- Migraine. See *Headaches, migraine*
- Milan, 290, 291 (meteorological means)
- Milk cures, 459, 505, 618-621, 717; therapeutic uses of milk treatment; localities for, 621; skimmed milk, 620; buttermilk, 620; German soured milk, 620, 621. See also *Whey cures*, *Koumiss*, and *Kephir*
- Millarany (Clew Bay), 259
- Millport (Firth of Clyde), 253
- Milltown-Mallbay, 259
- Minchinhampton and Minchinhampton Common, 271
- Mind, disorders of the. See under *Mental*
- Minehead, 249
- 'Mineral enzymes,' in regard to possible action of mineral waters, 328
- Mineral muds. See under *Fango* and *Mud baths*
- Mineral water baths. See *Baths of mineral waters*
- Mineral water deposits and mineral water muds, radium and radio-activity in, 329, 330, 339, 340, 395, 411, 416, 417, 599. See also under *Radio-activity*, *Radium*, and *Thorium*
- Mineral water health resorts. See under *Mineral waters, Spa-treatment*, and the names of the resorts
- Mineral water muds. See under *Fango* and *Mud baths*
- Mineral water treatment. See *Spa-treatment*
- Mineral waters. See also *Simple thermal waters*, *Muriated waters*, *Simple alkaline mineral waters*, *Muriated alkaline waters*, *Sulphated alkaline waters*, *Sulphated waters*, *Muriated-sulphated waters*, *Chalybeate waters*, *Arsenical mineral waters*, *Sulphur waters*, *Earthy mineral waters*, *Table waters*, and *Weakly mineralised cold waters*
- Mineral waters, action of, varies much in different individuals, 534. See also *Constitution of the patient*
- Mineral waters, addition of carbonic acid

- gas to make them 'keep well,' 350, 351, 597
- Mineral waters, artificial, 300, 334, 350, 351
- Mineral waters, careless use of, 366
- Mineral waters, changes occurring in after bottling, 350, 497, 536
- Mineral waters, chemical composition (results of analysis) may be expressed in salts or ions, 319
- Mineral waters, classification of, 324; various methods of classification, 318; defects in all methods of classification, 330
- Mineral waters, cryoscopy of, 319, 320, 321
- Mineral waters, definition of the term, 316
- Mineral waters, electrical conductivity of, 319
- Mineral waters, external use, 331. See also *Baths of mineral waters and Spa-treatment*
- Mineral waters, gases in, 323, 327, 343, 347, 348, 350, 532-536, 554, 579, 588, 596; inhalation of gases from, 350, 554, 579, 588
- Mineral waters, glairine, baregine, &c., in thermal waters, 323, 326, 330
- Mineral waters, hypertonic, 320, 342, 488; effects of internal use due to hypertonicity, 342, 488
- Mineral waters, hypotonic, 320; possible injurious effect of drinking exceedingly hypotonic water, 302
- Mineral waters, inhalation, pulverisation, and sprays of, 349, 464, 528, 532, 537, 539, 543, 554, 572, 574, 588, 604, 689; inhalation of gases from mineral waters, 350, 554, 579, 588
- Mineral waters, internal use of, 340. See also under *Spa-treatment*
- Mineral waters, isotonic, 320; advantage of isotonicity in regard to sprays and douches for the nose, naso-pharynx, &c., 349; advantage of the addition of salt to very hypotonic waters in some cases, 302, 349
- Mineral waters, living organisms in thermal waters, 323, 326
- Mineral waters, 'medicated' by addition or removal of mineral or gaseous constituents for therapeutic purposes, 350, 351, 547, 597, 695
- Mineral waters, mineral constituents of, 322, 323, 341-348
- Mineral waters, 'mineral enzymes' in regard to the possible action of mineral waters, 328
- Mineral waters, naphtha and bituminous material in, 323, 565, 574, 580
- Mineral waters, not all suitable for medical purposes, 316, 317
- Mineral waters, organic constituents in, 323, 326
- Mineral waters, origin of thermal springs, 317
- Mineral waters, osmotic pressure of, 319-321; osmotic action of, 342. See also under *Osmotic pressure*
- Mineral waters, poor in common salt (in regard to the treatment of renal dropsy &c.) 718
- Mineral waters, possible importance of the presence of very minute amounts of salts in, 327, 346
- Mineral waters, possible injurious effect of the constant use of natural or artificial aerated waters, 597
- Mineral waters, probable and traditional discovery of springs, 316
- Mineral waters, radio-activity in, 321, 322, 328, 329, 332, 335, 341, 372, 375, 382, 389, 395, 411, 416, 417, 440, 476, 538; radio-activity in different mineral waters compared, 321, 322, 418; radio-activity in regard to the external use of mineral waters, 332, 335; in regard to internal use, 329, 341; rapid loss of radio-activity from mineral waters, 322, 329, 382; radio-activity greatest in some of the least mineralised springs, 329; bactericidal action of radio-active mineral waters, 329. See also under *Radio-activity, Radium, and Thorium*
- Mineral waters, removal of sulphur or iron constituents for special purposes, 350, 351
- Mineral waters, salts and pastiles prepared from, 351
- Mineral waters, sipping the waters, effects of, 341
- Mineral waters, temperatures of the springs, extreme temperatures, 317
- Mineral waters, 'theory of ions' in regard to, 318
- Mineral waters, treatment by. See *Spa-treatment*
- MINOR, C. J., 669
- MIRQUEL, P., 20
- Miramonte Hotel at Pezzie, 217, 607
- Misdroy, 129, 130
- Miserey brine (Besançon), 181, 442
- Mistral wind, 44
- Mists, 34
- Misurina, Lago di (hotel), 217, 607
- MITCHELL, J. K., 308
- MITCHELL, WEIR. See *Weir-Mitchell treatment*
- Mittenwald, 213
- Mitterbad, 216, 523
- MITTERMAIER, K., 112, 762
- Modum (Norway), 185, 522
- MOEBIUS, P. J., 362, 701, 709
- Moedling, 221
- Moffat, 268, 504, 552
- Mogador, 111
- MOHR, L., 712
- Moinak (Crimea), and mud-baths at, 100, 337
- Moisture of the air. See *Humidity, atmospheric*
- Moisture of the soil and subsoil. See *Humidity of the soil and subsoil*
- Molins (Switzerland), 145
- Molitz, 175, 570
- Monaco, 84, 314
- Mondariz, 461

- Mondorf (Luxembourg), 184, **422**
 Mondsee, 220
 Monétier-de-Briançon, Le, 173, 593
 Monfalcone, 96
 Monkstown (Cork Harbour), 258
 Monnetier, 153
 Monsoons, 40, 43
 Monstein sanatorium, 140
 Monsummano, grotto of, 168, **395**
 Mont-Canigou sanatorium, 175, 569
 Mont-Cervin Hotel, near St. Luc, 147
 Mont-des-Oiseaux sanatorium, near Hyères, 81
 Mont-Dore, 179, 321, 392, **527**, 688, 692
 Mont Estoril (near Lisbon), 119
 Mont-Fleury, 151
 Mont-Pélerin (Switzerland), 152
 Mont-Valat (France), 180
 Mont-Revard, 171, 545
 Mont-Saint-Michel (Normandy), 122
 Mont-sur-Meuse sanatorium (Belgium), 184
 Montana (Switzerland), **142**, 607
 Montanvert (Mont-Blanc District), **171**, 608
 Montbarry, 564
 Montbolo Hill (Amélie-les-Bains), 174
 Montbuy, Caldas de. See *Caldas-de-Montbuy*
 Monte (Grand Canary), 115
 Monte Carlo, 83. See also *Monaco*
 Monte Fronte. See *Vetriolo*
 Monte Generoso, **162**, 608
 Monte Ortone, 445
 Monte Tésobo water. See *Ronceyno*
 Monte Video, voyage to, 70
 Montecatini, 168, 321, 396, 446
 Montegrotto, 395, **445**
 Montemayor, 170, **579**
 Montecor-Sarata, 230
 Montet, Le (Cransac), natural vapour baths, 592
 Montigny-en-Ostrevent, 'family sanatorium' at, 183
 Montmirail, 321, **489**, 495
 Montpellier, 294
 Montpellier (Strong), Spring at Harrogate, 535, 545, 546, 547
 Montreux, **150**, 236, 609, 622
 Montrond, 461
 Moog, R., 62
 Moor baths. See *Peat baths*.
 MOORE, NORMAN, 773
 MOORE, Sir J. W., 773
 Mooserboden hotel (Kaprunerthal), 220
 MORDHONST, CARL, 416, 463, 762
 Morecambe, 253
 Morecambe Bay, resorts on, 252
 Moreton Hampstead, 269
 Morgins-les-Bains, 147, **519**
 MORICE, G., 774
 MORISON, A., 408, 409, 762
 Moritz, Sanct. See *St. Moritz*
 MORLAND, E. C., 628
 Mornex, 153
 Morny spring of Châteauneuf, 521
 Morocco, coast of, 110
 MORRIS, MALCOLM A., 773
 Morrison Well of Strathpeffer, 551
 Morschach, 158
 Morthoe, 249
 Moscow, 286
 Moselle, resorts on the, 189
 Moserboden. See *Mooserboden*
 Mossò, ANGELO, 58
 Mostar (Herzegovina), 229
 Mother lye. See *Mutterlauge*
 Mother water. See *Mutterlauge*
 Motte, La. See *La Motte*
 Moudang, Le (sulphate of iron water), 524, 567
 MUDGEOT, A., 408
 Mouillère, La (Besançon), 181, 294, **442**
 MOUTILLOT, F. A., 762
 Mount Vernon Hospital, Hampstead, 274, 629
 Mountain railways, dangers of rapid ascents in persons with cardio-vascular diseases, 64
 Mountain sickness, 58
 Mountains, effect of on the atmosphere and climate of neighbouring localities, 50, 51
 Mourne Mountains (Ireland), 260
 Montiers-en-Tarentaise. See *Salins-Montiers*
 Moxon, W., 713
 Mucó-membranous colitis. See *Colitis, mucó-membranous*
 Mud baths, 306, **336**, 338, 339, 378, 379, 388, 393, 395, 418, 445, 520, **575**, 580, 581, 601. See also *Peat baths* and *Fango baths*
 Mud baths, action of, 338, 339
 Mud baths at Odessa and at the Crimean resorts, 100, **337**, 338
 Mud baths at Russian Baltic resorts, 131, 339
 Mud baths, 'diluted' form, 339
 Mud baths, local, **339**, 575. See also *Fango baths*
 Mud baths, marine, 337, 339, 580
 Mud baths of Scandinavian resorts, 132, 133, 185
 Mud baths, precautions in use of, 338, 339
 Mud baths, preparation of, 337, 575
 Mud baths, radium and radio-activity in fango and mineral water muds used for mud baths, 330, **339**, 395. See also under *Radio-activity* and *Thorium*
 Mud baths, salt, 100, 337, 339, 580
 Mud baths, sulphurous, 337, 554, 555, 580, 581
 Mud baths, temperature of, 338, 575
 Mud baths, various kinds of peat and mud baths, and various methods of application, **336-339**, 575, 580
 Mud baths, with massage, 339, 580, 581, 601
 Muchlbach, at Boppard (hydrotherapy), 188, 314
 'Muchlbrunnen' of Karlsbad, 321, 322, 476
 Muehlen. See *Molins*
 MUELLER DE LA FUENTE, E., 762

- MUELLER, FRANZ, 58, 60, 773
 MUELLER, FRANZ C., 762
 MUELLER, FRIEDRICH, 734, 762
 Muellingen water, 489
 Muenchen. See *Munich*
 Muenster-am-Stein, 189, 410, 425
 Muenster in Westphalia, 294
 MUENTZ, A., 60, 762
 Muerren, 149, 607
 Muerzzuschlag, 222
 Muggendorf (Franconian Switzerland), 203
 'Mugginess' of the weather and weather sensations, 27
 Mumbles, The, 250
 Mundesley-on-Sea, 257
 Mundesley sanatorium, 257
 Munich, 286
 Muriated alkaline group of table waters, 597, **598**
 Muriated alkaline waters, 325, 343, 345, **463**
 Muriated alkaline waters, arsenical, 526
 Muriated sulphated waters, 326, 345, **489**
 Muriated sulphur waters. See *Sulphur waters, muriated*
 Muriated waters, 324, **399**; internal use of, 400; external use of, 399; combined external and internal use of, 403; experiments in regard to the effects of their internal use, 400-403; diet in regard to their internal use, 403
 Muriated waters, simple. See *Muriated waters*
 Muriated waters, strong, 399; artificially concentrated, 399, 400; natural saturated or almost saturated brines, 404, 430, 434, 435, 437, 438, 442, 443, 444. See also *Brine baths*
 MURRAY, WILLIAM, 276
 MURRELL, W., 762, 773
 MURRI, A., 308
 Muscular exercise. See under *Exercises and Open-air exercise*
 Muscular rheumatism. See under *Rheumatism, muscular, and Fibrositis*
 Muskau, Bad, 204, **523**
 Mustapha Supérieur (Algiers), 108
 Muswell Hill (London), 283
 'Mutterlauge,' **399**, 400, 411, 412
 'Myelitis,' chronic results of. See under *Spinal cord affections*
 Myocardial disease. See under *Heart*
 Myomata (fibromyomata) of the uterus. See *Uterus, fibroid tumours of*
 Myositis, rheumatic. See under *Rheumatism, muscular, and Fibrositis*
 MYRTLE, A., 762
 MYRTLE, A. S., 762
 Myxodema, 732
 Namur, 184
 Nancy, 294
 Nantes, 294
 Nantwich, 265, **420**
Naphtha and bituminous material in springs, 323, 565, 574, 580
 Naples, and its meteorological records, **89**, 236, 291, 293
 Napoli. See *Naples*
 Narcolepsy, 737
 'Narsen' spring of Kislovodsk, 595
 NASH, 'Beau,' at Bath, 377
 Naso-pharynx, affections of. See under *Nose*
 Nassau (hydrotherapy), 190; 314
 'Natroine' of Rippoldsau, 350, **510**
 Nauheim, Bad, 192, **405**. See also *Nauheim treatment*
 Nauheim, Bad, the Kur-Brunnen and the Ludwigs-Brunnen sometimes mixed together for internal use, 350, 406
 Nauheim baths, 334, 406, **407**. See also under *Thermal Soolbaeder and Nauheim treatment*
 Nauheim baths, artificial, 334, 351, 695
 Nauheim exercises. See *Schott resistance-exercises and Nauheim treatment*
 Nauheim treatment for chronic affections of the heart and circulatory system, and indications for the treatment, 357-362, **407-410**, 413, 480, 483, 491, 500, 545, 655, 691, **694-696**, 719, 731
 Naurod sanatorium, 191
 Navas Mountains, sanatorium, 169
 Naye, Rochers de, 152
 Nayland (Suffolk), sanatorium near, 275
 Needle douche. See *Douche, needle*
 NEISSER, A., 346, 648, 762
 NENADOVICS, L., 762
 Nenndorf, 336, 337, **553**
 Nenndorf, Bad, 209
 Neon in the atmosphere, 17
 Nephritis, chronic, 712; chronic interstitial, 713; slight forms, 457, 713; common salt in mineral waters in regard to the treatment of renal dropsy, 713
 Nérès-les-Bains, 181, **390**
 Neroburg (near Wiesbaden), 191
 Nerone, Bagni di, 472
 Nerothal, Bad, 314
 Nervi, 87
 Nervous system, diseases of, 724; organic diseases, 371, **724**, 728, 729; functional diseases, 725
 Neu-Prags, 217
 Neu-Ragoczi (Prussian Saxony), 429
 Neu-Schmecks, 226
 Neudorf (Constantinsbad), 517
 Neuenahr, 188, 368, **457**, 625
 Neuenhain water, 424
 Neuhaus (Bavaria), 433
 Neuhaus (Styria), 222, **385**
 NEUKOMM, M., 563, 762
 Neumarkt, Wildbad, 324
 Neuralgia, facial, 730

'NACHKUR.' See *After-cure*

NAGEL, J., 629

Nagyvarad. See *Grosswardein*

Nairn, 254, 280 (meteorological means)

- Neuralgia, gouty and rheumatic, 729.
See also under *Neuritis* and *Fibrositis*
- Neuralgia, malarial, 730
- Neuralgia, trigeminal, 730
- Neurasthenia, 727; value of rest combined with open-air treatment. See also *Debility, general*
- Neurasthenia with chronic headache, 736
- Neurasthenia with 'colica mucosa' and muco-membranous colitis, 706
- Neurasthenia with dysmenorrhœa, 720
- Neurasthenia with gastric disorders, 703
- Neurasthenia with habitual constipation, 704
- Neuritis and 'neuralgias' (sciatica, &c.), gouty and rheumatic, 372, 574, **729**, 730. See also under *Fibrositis*
- Neuritis, brachial, 729
- Neuritis, glycosuric or diabetic, 730
- Neuritis, multiple peripheral (polyneuritis), 371, 729
- Neuritis, sciatic, 729
- Neuroses, paroxysmal, 55, 691. See also under *Asthenia* and *Headache, migraine*
- NEUSKER, R., 351
- Neustadt-un-der-Haardt, 193, 622
- Neustadt-Eberswalde. See *Eberswalde*
- Neuwied, 188
- New Brighton, 252
- New Forest (Hampshire), 270
- New Quay (Cardigan Bay), 250
- New Zealand, voyages to, 71
- Newbury, 270
- Newcastle (Dundrum Bay), 260
- Newcastle (Wicklow), 261
- Newport (Clew Bay), 259
- Newport (Isle of Wight), 244
- Newquay (Cornwall), 248
- Neyrac, 521
- Nice, **82**, 236, 314
- NIEBERGALL, 751
- Niederbronn (Alsace), 193, **427**
- Niederdorf (Pusterthal), 217
- Niederlangennau (Prussian Silesia), 206, **506**
- Niedermendig, 189, 598
- Niedernau, 516
- Niederselters, 190, 598. See also *Selters-water*
- Niederwald (Rhine), the, 188
- Niederweiler (near Badenweiler), 197
- Niendorf, 128
- Nieuport-Bains, 125
- Nile voyage, the, 105
- Nijmegen, 187
- Nitrates in mineral waters, 599, 604
- Nitrogen in mineral waters, 323, 348, 350, 579, 588; inhalation of, 350, 579, 588
- Nitrogen in the atmosphere, 17
- Noisy-le-Grand, 'agricultural colony' for tuberculous convalescents, 183
- NOORDEN, C. von, 10, 343, 346, 348, 360, 401, 402, 403, 475, 583, 619, 653, 702, 703, 706, 712, 715, 763
- Norderney, 126
- Nordrach (Black Forest), 196
- Nordrach-Colonie (Black Forest), Dr. Walther's sanatorium, 196, 627, 679
- 'Nordrach in Wales' sanatorium, 251
- 'Nordrach-on-Dee' sanatorium (Banchory), 278
- 'Nordrach-upon-Mendip' sanatorium, 270
- Norfolk 'broads,' 257
- Norfolk, coast of, 256
- 'Norman Switzerland,' the, 183
- Normandy, coast of, 122
- Norroy-sur-Vair, 593
- NORSTRÖM, G., 658
- North America, voyages to, 69
- North American resorts of high altitude, compared, 137
- North Berwick, 255
- North Downs (England), 272
- North Sea, composition and temperature of the water of, 130, 449, 451
- Northwich (Cheshire), 265, 421
- Northwood, and the Mount Vernon Hospital sanatorium at, 274, 629
- Norway, inland resorts of, 184
- Norway, seaside resorts of, 132, 133
- Norwich, 294
- Norwood, Upper (London), 284, 295
- Nose, chronic catarrh, 687; the coryza form of 'hay fever,' 691; isotonic mineral water sprays and douches for the nose, 349. See also *Adenoid vegetations of the naso-pharynx*
- Nossa-lcs-Buins, 574
- NOTHNAGEL, H., 763
- Nottinghamshire Sanatorium (Sherwood Forest), 275
- Nottingham sulphur water, 518
- Nuernberg, 285, 294
- Oakwood Park Hotel (Conway), 251
- Oatlands Park Hotel (Weybridge), 271
- Oban, 254
- Ober-Aumergau, 213, 295
- Oberalp route (Switzerland), resorts of, 146
- 'Oberbrunnen' of Obersalzbrunn, 458
- Oberengadin. See *Engadine, Upper*
- Obergurgl (Oetzthal Alps), 218
- Oberhof (Thuringia), **201**, 607
- Oberkaufungen sanatorium (near Cassel), 210
- Oberlahnstein table water (near Ems), 598
- Obermais (Meran), 214
- Obersalzbrunn, 205, **458**, 621
- Oberstdorf, 213
- Oberweiler (near Badenweiler), 197
- Obesity, 480, **659**, 695; cardiac troubles in, 695
- Obladis, 218, **557**
- Ocean climates, 69. See also under *Climates, marine*
- Ocean currents, 39
- 'Ocean sanatorium' ships (ships specially constructed to serve as sanatoriums for invalids), **74**, 677
- Ocean voyages. See *Voyages*

- Ocean water, composition &c. of Atlantic sea-water, 449, 451
 Ochill Hills sanatorium, 277
 O'CONNELL, M. D., 664
 Ocular conditions in regard to climates and spa-treatment, 738
 Odenwald, resorts of the, 193
 Oderberg sanatorium (St. Andreasberg), 199
 Odessa, and mud-baths at, 100, 337
 Odilienberg (Vosges Mountains), 193, 607
 Odours in the atmosphere, 18, 19
 Oedesloe, 207, **428**
 OEFELE, 705
 OERTEL, M. J., 195, 227, 358, 359, 614, 695, 763; for 'Oertel's treatment' by graduated walking and climbing exercise see under *Terrain-Cur*
 Oesteråsen sanatorium (Sweden), 185
 Oetz, 218
 Oeynhausén, 208, 356, **423**, 615, 724, 728
 Ofen. See *Buda-Pest*
 Offenbach water, 452, **467**
 Oil springs, radio-activity in, 322
 Okehampton, 269
 Old age and premature senility, 26, 64, 281, 632, **666**, 688, 692, 696, 702, 740, 743
 Old age, aural changes in, 740
 Old age, constipation in, 666
 Old age, dyspepsia in, 702
 Old age, influence of atmospheric temperature in, 26
 Old age, influence of mental recreation in, 281, 632, 667
 Old age, influence of travelling and change of surroundings in, 281, 632, 667; visits to interesting towns in, 281
 Old age, pulmonary emphysema in, 688
 Old age, senile changes in the heart and circulatory system, 692, **696**; 'cardio-vascular asthma' in, 692; danger of sudden ascents to high altitudes by mountain railways, 64
 Old age, skin affections in, 743
 'Old Sulphur Well' of Harrogate, 535, 545, 546, 547
 Oléron island (France), 122
 Olette, 570
 Oliva, near Zoppot, 129
 OLIVER, G., 60, 547, 548, 763
 OLIVER, T., 748
 Ollette, 175
 ONIMUS, 307
 Ontaneda, 170, 579
 OORDT, M. VAN, 763
 Open-air education in scrofulous affections and predisposition to tuberculosis, 630
 Open-air exercise as preventive treatment of cholelithiasis, 709
 Open-air exercise, cycling exercise and 'cyclotherapy', 358, 410
 Open-air exercise, graduated walking and climbing, 358. See also *Terrain-Cur*
 Open-air exercise in regard to cases of uric acid sand and gravel, 714
 Open-air exercise in regard to the prevention of dysmenorrhœa, 720
 Open-air exercise in regard to the prevention of pulmonary tuberculosis, 626
 Open-air exercise in tendencies to 'intestinal auto-intoxication', 733
 Open-air exercise, value of in many dyspeptic cases, 492, 700
 Open-air exercise, value of in some cases of tendency to headaches, 734
 Open-air sanatoriums. See under *Sanatorium treatment* and *Open-air treatment*
 Open-air schools for scrofulous children &c., 630
 Open-air treatment and open-air education for children with scrofulous affections and predisposition to tuberculosis, 630
 Open-air treatment associated with spa-treatment, 352, 353, 356, 635
 Open-air treatment at ordinary health-resorts, 352, 353, 356, **635**
 Open-air treatment at sanatoriums for pulmonary tuberculosis, 625-630. See also *Sanatorium treatment*
 Open-air treatment in general debility, 644
 Open-air treatment in pulmonary tuberculosis, **626**, 668. See also under *Sanatorium treatment for pulmonary tuberculosis*
 Open-air treatment in various chronic affections, 353, 635, 644, 728
 Open-air treatment, opportunities for, in regard to the selection of a health-resort, 635
 Open-air treatment with rest in neurasthenic cases, 728
 Oporto, 119
 Oppenau (Black Forest), 196
 'Oran, 109
 Orb, 210, 434
 ORB, W. M., 773
 Orduna, 448
 Orezza, 93, **521**
 Oriol, 522, 599, 600
 Orkney Islands, 133
 Ormea, 167
 Ormesson sanatorium (France), 183
 Ormont-dessous, 148
 Ormont-dessus, 148
 Orotava (Teneriffe), 113, 236
 Orta (Italy), 162
 ORTWEILER, 734
 Osborne House (Isle of Wight), 243
 Osmotic pressure, in regard to nasal douches, pharyngeal sprays &c., 349
 Osmotic pressure of mineral waters, 302, **319-321**, 333, 342, 349, 488; effects due to, 302, 333, **342**, 488; influence on the functions of the stomach, 302, **342**; influence on the functions of the intestines, 488; influence on the osmotic pressure of the blood, 320, **321**, **333**, **342**; advantage of making mineral waters and sea-water isotonic with the blood in some cases, 302, 349,

- 451; advantage of the addition of salt to very hypotonic waters in some cases, 302, 349
- Osmotic pressure of the blood, in regard to the use of mineral waters and baths, 320, 321; influence of drinking mineral waters on the osmotic pressure of the blood, 342; influence of brine and other baths on, 333; advantage of making mineral waters and sea-water isotonic with the blood in some cases, 302, 349, 451
- Osmotic pressure of sea-water in regard to subcutaneous injections, 451
- Ospedaletti, 85
- Ossiacher See, 223
- Ost, W., 229, 676
- Ostend, 125
- Osteo-arthritis. See *Rheumatoid arthritis*
- Ott, A., 763
- Ouchy (Lake of Geneva), 152, 609
- Overstrand (near Cromer), 257
- Overwork, mental. See *Mental overwork*
- Oviedo, Caldas de. See *Caldas-de-Oviedo*
- Ovoen, 261
- Oxaluria, 586, 715, 716; alimentary oxaluria, 716; gouty oxaluria, 586; oxaluria with dyspepsia, 716; possible relationship of oxaluria to alimentary glycosuria in some cases, 716
- Oxford, 294, 295
- Oxted (Surrey), 274
- Oxygen in mineral waters, 323; oxygen employed to make artificially effervescent baths, 547
- Oxygen in the atmosphere, 17
- Oxysulphide of carbon. See *Carbonyl sulphide*
- Oystermouth (Wales), 250
- 'Ozone baths,' 315
- Ozone in the atmosphere, 17
- PACHT, T. VON, 61, 763
- Padstow (Cornwall), 248
- Paignton (near Torquay), 246
- Paimpol, 122
- Palermo, 91, 92, 236, 291 (meteorological means)
- Pallanza, 161, 165, 166, 236, 609
- Palma (Island of Majorca), 94
- Palma (one of the Canary Islands), 116
- Palmas, Las (Grand Canary), 115, 236
- Pancerevo (Bulgaria), 231
- PANNWITZ, G., 756
- Panticosa, 169, 397, 578
- PANZER, T., 337, 482, 494
- Para-metritis, chronic remains of, 721. See also under *Uterus*
- PARACELSUS, 363, 370, 374, 381, 599
- Paracelsus-quelle of St. Moritz, 502
- Paracuellos, 579
- Phrad, 228, 523, 558
- Paralysis. See under *Nervous system, organic affections*
- Paralysis, general, 728
- PARAMORE, W. E., 348, 583, 584, 618
- Parasitic skin affections. See under *Skin*
- Paris, 287, 293, 314; meteorological means for, 293; the neighbouring country, 287
- Paris-Plage, 125
- PARISER, CURT, 367, 763
- PARKE, T. H., 750
- Parknasilla (Co. Kerry), 259
- Parkstone (Dorset), 245
- 'Paroxysmal neuroses,' sometimes aggravated at the seaside, 55
- Parpan, 141, 145, 503
- PARRISH, 627
- Partenkirchen, 213, 608
- PARTOS, A., 763
- PARQUIER, E. DE, 110
- Passage (Cork Harbour), 258
- PASSOW, K. A., 739, 763
- Passugg (Switzerland), 155, 480, 519
- Passy, chalybeate water, 524
- PANTEUR, L., 57
- PAU, 177, 236
- 'Pauline' spring of Vals-les-Bains, 598
- PAUL, HERMANN, 763
- Pausa. See *Linda-Pausa*
- Pavillon-de-BelleVue (Meudon), 287
- Pavillon, Source, at Contrexéville, 321, 582, 586, 587
- PAY, F. W., 713
- PAWLOW, J. P., 344, 401, 402, 403, 733, 734, 764
- Peat baths, action of, 338, 339
- Peat baths and ferruginous peat baths, 336-339, 478, 480, 481, 482, 498, 500, 501, 506, 508, 547, 551, 721. See also *Mud baths*
- Peat baths, local, 339, 482
- Peat baths, precautions in use of, 338, 339, 482
- Peat baths, preparation and administration, 336-338, 482
- Peat baths, temperature of, 338, 482
- Peat baths, various kinds of peat and mud baths and various methods of application, 336-339
- Pecsenyéd. See *Sauerbrunn in Hungary*
- Pebbles, 277, 314
- Peel (Isle of Man), 253
- Pegli, 86
- Peiden, 155, 590
- Pejo, 216, 514
- PELON, 349
- Pelvic cellulitis in women, chronic remains of, 721. See also under *Pelvic organs in women*
- Pelvic organs in women, chronic affections of, and the remains of pelvic cellulitis and pelvic peritonitis, 370, 389, 399, 412, 419, 444, 483, 567, 639, 719-722
- Pen-Bron (France), sanatorium, 122
- Pen-y-Gwryd, 276
- Pennarth, 250
- Pendyffryn Hall sanatorium ('Nordrach in Wales'), 251
- Penmaenmawr, 251
- PENROSE, F., 773
- Pensarn, 252

- Penticouse. See *Panticosa*
 Penzance, 247
 PENZOLDT, F., 764
 PEPYS, S., 489
 Perimetritis, chronic remains of, 721.
 See also under *Pelvic organs in women*
 Peritonitis, localised, chronic remains of, 370, 389, 639, 721. See also under *Pelvic organs in women*
 Peritonitis, pelvic, remains of, 370, 639, 721. See also under *Pelvic organs in women*
 Perityphlitis. See *Appendicitis*
 Pernambuco, voyage to, 70
 Pernau (Livonia), and mud baths at, 131, **339**
 PERNTER, 45
 Perrier water, 599
 Perrière-Choussy, Source, at Le Bourboule, 321, 526, 527
 PERRY, 113
 Perugia, 169
 PESCI, 347
 Pesio, Val, 167
 Pest. See *Buda-Pest*
 Pestrin, Le, 521
 Peterborough, 294
 PETERS, H., 764
 Petersberg (Siebengebirge), hotel on the, 188
 Petersdorf (Riesengebirge), 205
 Petersfield (Hampshire), 274
 Petersthal (Black Forest), 196, 418, **511**, 607
 PETIT, C. A., 764
 Pezzie (Tirol), 217
 Pfäfers (Pfäfers, Pfeffers). See *Ragatz-Pfäfers*
 Pfänder hotel, above Bregenz, 159
 Pfeffers. See *Ragatz-Pfäfers*
 PFEIFFER, E., 360, 764
 Pharynx, chronic catarrh, &c., 687. See also *Adenoid vegetations of the nasopharynx*
 PHILIP, A., 173
 PHILIP, R. W., 685
 Phlebitis. See under *Veins*
 Phosphates in mineral waters, 589, 604
 Phosphaturia, 716
 'Phosphaturic albuminuria.' See *Albuminuria, phosphaturic*
 Phthisis pulmonalis. See *Tuberculosis, pulmonary*
 Piatigorsk (Caucasus), 231, 339, **580**
 PIATKOWSKY, M., 582
 PIATOT, A., 329, 440
 PICHLER, W., 756
 PIDOUX, JEAN, 593
 Pierrefonds, 183, 349, **573**
 Pietrapola (Corsica), 574
 Pigmentation of the skin, due to sunlight, 29
 Pignieu. See under *Andeer-Pignieu*
 Pilatus mountain, hotels on, 150, 157
 Piles. See *Hæmorrhoids*
 Pine baths, 315
 Pinewood sanatorium (Berkshire), 274
 Pins, Sanatorium des (Lamotte-Beuvron), 181
 Piora hotel (Switzerland), 146
 Pisa, 88
 Pisa, Bagni di. See *San Giuliano*
 Pisciarelli springs, 472, **524**
 Pistyan. See *Pystjan*
 Pitkeathly waters. See *Bridge-of-Earn*
 Pitlochrie, 278
 Pitlochry, 314
 Plaetzig (Black Forest), 195
 Plan-de-Phazy, 445
 Planches, Les, 151
 Plans-de-Frenière, Les, **147**, 154
 Plants, scents of, in the atmosphere, 18
 Plattensee (Balaton Lake), and its mineralised water, 229, 601
 PLEHN, F., 104
 Plethora, 534, 659, 665, **698**, 707, 719;
 in connection with hæmorrhoids, 707;
 in connection with menorrhagia, 719;
 in connection with the climacteric period in women, 665; plethoric type of obesity, 659; 'abdominal plethora,' 534
 Pleural effusion, remnants of, 690
 Pleurisy, remnants of, 690
 PLINY, THE ELDER, 394, 398, 472, 498, 549, 575, 668
 Ploen, 207
 Plombières, 182, 322, 329, 331, 372, **388**, 526, 548, 640, 705, 706, 721; radio-activity of its springs, 329, 388
 'Plombières' baths and douches, 389, 548
 'Plombières treatment' for muco-membranous colitis, &c., **389**, 547, 548
 PODWYSZOZZKI, W., 620
 Poertschach (Würther See), 223
 Poestyen or Poestyen-Teplitz. See *Pistyan*
 POGGIO BRACCIOLINI, 301, 558
 POJMAN, 229
 Pola, sunshine record at, 98
 POLLOCK, J. E., 684
 Polycythæmia of high altitudes, 60, 62
 Polyneuritis. See *Neuritis, multiple peripheral*
 Polyuria. See *Diabetes insipidus*
 Polzin chalybeate spring, 516
 Ponta Delgada (San Miguel), 116
 Ponte-a-Serraglio (Bagni-di-Lucca), 168, **594**
 Pontresina, **144**, 608
 Poole Harbour, 245
 Poprad (Hungary), 227
 Porlock, 249
 Pornic, 122
 Porretta, 168, 526, **577**
 PORT, H., 53
 Port Erin (Isle of Man), 253
 Port Stewart, 260
 Porta Coeli Sanatorium (Spain), 169
 Portbury (Luftkur Sanatorium), 270
 PORTER, 541
 Portishead, 250
 Porto d'Ischia, 472
 Porto Rose, 96
 Portobello (near Edinburgh), **254**, 284

- Portoferraio (Elba), 89
 Portofino, 88
 Portrush, 260
 Portugal, coast of, 119
 Portugal, inland health resorts of, 170
 Portugalete, 119
 Posilipo (Posilippo), 89
 Positano, near Amalfi, 90
 POSKIN, A., 324, 764
 Potsdam, 208
 Pougues-les-Eaux, 181, 321, 461, 582, **592**
 'Pouhon' springs at Spa (Belgium), 498
 Pouillon, 445
 'Poussée thermale,' 361, **366**, 371, 387, 527, 583, 742; during treatment at La Bourboule, 527; during treatment by prolonged tepid baths as at Loeche-les-Bains, 387, 742
 POWELL, Sir R. D., 654, 694, 764
 POYNTON, F. J., 620
 Pozzuoli, 397, 447, **472**
 Praetignau Valley, resorts of, 145
 Prager Wildsee, 217
 Prague, 286
 Pralognan, **172**, 491
 Prats-de-Mollo, 175
 Pré-Saint-Didier, 167, **396**
 Prehlau, **459**, 598, 600
 Préchacq-les-Bains, **394**, 574
 'Précieuse' spring at Vals-les-Bains, 456, 457
 Premature senility. See *Old age and premature senility*
 PRESCH, B., 764
 Prese, Le, 155, **564**, 608
 Pressure, atmospheric or barometric. See *Atmospheric pressure*
 Prestatyn, 252
 Preste, La, 175, **570**
 Prien (near the Chiemsee), 213
 PRIESSNITZ, V., 207, 300
 PRIESTLEY, JONEPH, 596
 PRIESTLY, J. G., 58, 755
 Princetown (Dartmoor), 269
 PRITCHARD, URBAN, 739
 Promontogno, 155
 PROUST, A., 489, 764
 Pruritus ani, 707
 Pruritus senilis, 743
 Pruritus, various causes of, 743
 'Pseudo-rheumatic' affections of the joints and fasciæ, 655
 Psoriasis, 387, 583, **742**, **743**. See also under *Skin affections*
 Psychical disorders. See under *Mental depression &c.*
 Psychical influences at health resorts &c. See under *Mental factor*
 Puda, La, 579
 Puellna water, 225, 320, 488, 489, 494
 Puente Viesgo, 448
 Püspökfürdő (Grosswardein). See *Grosswardein*
 PUGLIESE, A., 343
 PUJADA, F., 764
 Pulmonary emphysema. See *Emphysema of the lungs*
 Pulmonary tuberculosis. See *Tuberculosis, pulmonary*
 Pulverisation of mineral waters, 349. See also *Inhalation, pulverisation, and sprays of mineral waters*
 Pure air treatment. See *Open-air treatment*
 Purgative mineral waters. See *Sulphated mineral waters and Muriated-sulphated waters*
 Purgative mineral waters, doses of, 495, 547
 Purgative mineral waters, table of analyses, 494, 495
 Purton Spa, 489
 Putbus (Island of Ruegen), **129**, 130
 Puteoli. See *Pozzuoli*
 Putney Hill (London), 283
 Puy, Le, 180
 Puzzichello (Corsica), 574
 Pwllheli (Cardigan Bay), 251
 Pyatigorsk. See *Piatigorsk*
 Pyelitis, chronic, 717
 Pyrawarth, 517
 Pyrenees, compared with the Swiss Alps, 174
 Pyrenees, French, 174
 Pyrenees, Spanish, 169
 Pyrenees, sulphur waters of, 536-541, 564-570
 Pymont, 208, 425, **508**
 Pystjan, 228, 322, 337, **557**
 QUANTOCK Hills, 270
 QUARRIER, W., 253, 285
 Queenstown (Cork Harbour), 258
 QUÉNT, 707
 QUINTON, R., 449, 451, 768
 RABBI (Tirol), 216, **513**
 Rachitic and weakly children, 647
 Radegund (Styria), 223
 Radein, 459
 Rademaker, J., 773
 Radio-active elements and minerals, 322
 Radio-activity in Baden-Baden springs and in other springs of the Black Forest, 321, 322, 417
 Radio-activity in French springs, 322, 329, 349
 Radio-activity in Gastein springs, 322, **382**, 418
 Radio-activity in Italian springs, 322
 Radio-activity in Karlsbad springs, 418, 476
 Radio-activity in mineral waters, **321**, 322, 328, 329, 332, 335, 341, 372, 375, 382, 388, 395, 411, 416, 417, 440, 476, 538; radio-activity in different mineral waters compared, 321, 322, 418; radio-activity in regard to the external use of mineral waters, 332, 335; in regard to internal use, 329, 341; rapid loss of radio-activity from mineral waters, 322, 329, 382; radio-activity greatest in some of the least mineralised springs,

- 329; bactericidal action of radio-active mineral waters, 329. See also under *Radium* and *Thorium*
- Radio-activity in oil springs, 322
- Radio-activity in Plombières springs, 329, 388
- Radio-activity in rain and snow and ordinary drinking waters, 322, 329, 599
- Radio-activity in regard to the external use of mineral waters, 332, 335
- Radio-activity in regard to the internal use of mineral waters, 329, 341
- Radio-activity in simple thermal waters, 329, 372, 375, 382, 389
- Radio-activity in the soil and atmosphere, 32, 57, 322, 328
- Radipole sulphur water, 548
- Radium and radio-activity in 'fango' and mineral water muds used for mud baths, 330, **339**, 395. See also under *Radio-activity* and *Thorium*
- Radium and radio-activity in mineral water deposits and mineral water muds, **329**, 330, **339**, 340, 395, 411, 416, 417, 599. See also under *Radio-activity* and *Thorium*
- Radium in deposits from ordinary cold waters, 599
- Radium in sea-salt, 449, 599
- Radium, relation to the helium in mineral waters, 17, 324, 328, 349, 538
- RAE, W. F., 764
- Ragatz-Pfäfers and Ragatz, 155, 156, 368, **374**, 608, 609, 730
- Ragusa, 98
- Raillère, La, spring of Cauterets, 176, 321, 536, **538**, 539
- Rain, 34
- Rainfall, **34**, 51, 280, 293; influence of mountains on, 51; medical advantages and disadvantages of much rainfall, 35; rainfall averages for resorts in the British Islands, 280; rainfall averages for great cities of Europe, 293
- Rainha, Caldas de. See *Caldas-de-Rainha*
- Rainy seasons, 34
- Rajeczfürdő (Rajecz-Teplitz), 228, 385
- Rajecz-Teplitz. See *Rajeczfürdő*
- Rakoczy (Bud-Ragoczi). See *Neu-Ragoczi*
- Rakoczy spring of Kissingen, 320, 348, 401, 414
- Ramleh (Egypt), 101
- RAMNAY, Sir W., 17, 324, 328, 377
- Ramsey (Isle of Man), 253
- Ramsgate, 239
- Ranfurly Hotel (Bridge of Weir), 253
- RANGLARET, A., 360, 764
- Rank-Herlein, 517
- RANKE, K. E., 15
- RANSE, F. DE, 764
- RANSOME, A., 18, 29, 282, 628, 764
- Rapallo, 87
- Rappoltsweiler, 193, **588**
- Rasses, Les (Swiss Jura), 160, 561
- Rastenberg, 516
- Ratisbon. See *Regensburg*
- Ratzes, 216, **523**
- RAUOÉ, P., 764
- Raynaud's disease, 714
- Reaction, hydrotherapeutic. See under *Hydrotherapy*
- Reactive powers, individual, in regard to therapeutic indications, 55, 312, **632**, **633**, 644, 671, 682. See also under *Constitution of the patient*
- Rebhaus sanatorium (near Freiburg-im-B.), 198
- Recoaro, 167, **522**
- Recreation in connection with treatment at health resorts &c., 281, 354, 355, **613**, 631
- Rectum, chronic catarrh, 707. See also under *Hemorrhoids* and *Colitis*
- Red Sea, composition of the water of, 449
- Redcar, 255
- Redhill and its neighbourhood, **272**, 274, 295
- Refsnaes sanatorium (Denmark), 132
- Regensburg, 294
- Reginaris water (Niedermendig), 598
- REGNARD, PAUL, 61, 764
- REGNAULT, P., 440, 764
- Rehburg, Bad, and sanatoriums at, **209**, 603
- Rehme-Oeynhausen. See *Oeynhausen*
- Reiboldsgrün, **203**, 516
- REICHT, F., 628
- Reichenhall, 212, 349, 350, 358, **432**, 614, 621, 689
- Reigate and neighbouring hills, **272**, 273, 295
- REIMER, H., 10, 291, 292, 764
- Reims, 294
- REINBACH, G., 707
- Reinbeck (Sophienbad), near Hamburg. hydrotherapy at, 314
- Reinerz, Bad, 206, **505**, 621, 678
- REINHARDT, C. E., 628
- Reipertsweiler, 'Renine' water, 599
- Reitzenhain, 204
- Reknaes sanatorium (near Molde), 185
- Remoncourt, 593
- Renaiss., 181, 599
- Renal diseases. See *Kidneys, diseases of*
- 'Renchthal spas.' See *Kniebis Mountain resorts*
- René Sabran sanatorium, near Hyères, 81
- Rengsdorf (Westervald), 188
- 'Renine' water ('Eau Nitrée d'Alsace') of Reipertsweiler, 599
- Renlaigue, 179, **521**
- Rennes-les-Bains, 175, 393, **520**
- RENOU, F., 49
- RENZ, W. T. von, 765
- Resistance exercises. See *Exercises, resistance*
- Respiratory exercises. See *Exercises, respiratory*
- Respiratory organs, non-tuberculous diseases, 687
- Respiratory organs, tuberculosis. See *Tuberculosis, pulmonary, and Tuberculosis, laryngeal*
- Rest and recreation in connection with treatment at health resorts &c., 281, 354, 355, **613**, 631

- Rest as a prophylactic measure against cardiac disease after acute rheumatism, 693
- Rest combined with open-air treatment for neurasthenia, 728
- 'Rest-cure.' See under *Rest* and *Weir-Mitchell treatment*
- Rest, importance of, during convalescence from acute rheumatism, 654, **693**, 694
- Rest, importance of, in chlorosis and other anæmic conditions and general debility, 366, 641, 642, 644
- Rest, use of an after-cure for prolonging the period of rest, 727
- REUMONT, A., 765
- Reutlingen, 556
- Revel (Erthonia), 132
- REVILLET, L., 765
- REYNOLDS-BALL, E. A., 774
- RHEINBOLD, M., 329
- Rheinfelden, 160, 400, 404, **436**
- Rhens table water, 598
- Rheumatic fever. See *Rheumatism, acute*
- 'Rheumatic gout.' See *Rheumatoid arthritis*
- Rheumatism, acute, cardiac troubles from, 654, **693**, 694
- Rheumatism, acute, convalescence from, **654**, 693
- Rheumatism, articular, 654. See also *Rheumatism, acute*
- Rheumatism, 'chronic rheumatism,' 608, **655**; localities for an after-cure to spa-treatment, 608. See also under *Rheumatism, muscular, Fibrositis, and Rheumatoid arthritis*
- Rheumatism, gonorrhœal. See *Gonorrhœal rheumatism*
- Rheumatism, muscular, 310, 372, **658**. See also under *Fibrositis*
- Rheumatism, 'pseudo-rheumatic' affections of the joints and fasciæ, 655
- Rheumatoid arthritis, chronic, 311, 608, **656**; localities for an after-cure to spa-treatment, 608
- Rhine Palatinate, resorts of, 192, 193
- Rhine, resorts on the, 187; localities between Bonn and Bingen as residential resorts, 295; health resorts of Rhenish Prussia, 186
- Rhinitis, chronic. See under *Nose*
- Rhoengebirge, resorts of the, 211
- Rhone Glacier, Belvédère Hotel, close to, 146
- Rhone Glacier Hotel, 146
- Rhone valley (Switzerland), resorts above, 146, 147, 148, 154
- Rhone valley (Switzerland), resorts of, 154
- Rhyl, 252
- RICHARDS, P. A. E., 446
- RICHARDSON, Sir B. W., 627
- RICHET, CHARLES, 685
- Richmond (Surrey), 271, 295, 314
- Rickmansworth, 274
- Rieder Alp, 147, 607
- Rieder-Furka, 147, 607, 608
- RIESENFELD, E. H., 328, 330, 765
- Riesengebirge, health resorts of the, 204
- Rietbad, 564
- Riffelalp (above Zermatt), 147, 607
- Riffelhaus (above Zermatt), 147
- Riga, 131
- Rigi Colony sanatorium, 150
- Rigi-First, 607, 608
- Rigi-Kaltbad, 314, 607, 608
- Rigi Mountain, hotels on, 150, 157
- Rigi-Scheidegg, 150, 607, 625
- 'Rigolette' spring of Vals-les-Bains, 456, 457
- RINGER, S., 765
- Ringwood (New Forest), 271
- Rio (Elba), 524
- Rio de Janeiro, voyage to, 70
- Rio de la Plata, voyage to, 70
- Riolo, 447, 577
- Ripon, Aldfield Spa near, 548
- Rippoldsau, 195, **510**, 607, 609
- Ritten, the (near Botzen), 215
- Riva (on the Lago di Garda), 163, **165**
- Rivanazzano, 446
- 'Riviera,' Cornish, 247
- 'Riviera,' Devonshire, 246
- Riviera di Levante. See *Riviera, Eastern*
- Riviera di Ponente. See *Riviera, Western*
- Riviera, Eastern, 87
- Riviera, French. See *Riviera, Western*
- 'Riviera,' Irish, 259
- Riviera, Italian, 85, 87
- 'Riviera,' Lancashire, 253
- 'Riviera,' Liburnian, 97
- 'Riviera' of Salò (Lago di Garda), 163, **164**
- 'Riviera' of the Garda Lake, 163, **164**
- 'Riviera' of the Lake of Geneva, **150**, 164
- 'Riviera,' or 'Undercliff' of the Isle of Wight, 164, **243**
- 'Riviera,' Portuguese, 119
- Riviera, The. See *Riviera, Western*
- Riviera, Western, 78
- Roads and dust, 16, 19; treatment of dusty roads, 19
- ROBERTS, A., 765
- ROBERTS, FREDERICK, 765, 773
- ROBERTS, Sir W., 463, 765
- ROBERTS, T. R., 765
- ROBERTSON, J. MCGREGOR, 441
- ROBERTSON, W. H., 348, 765
- ROBIN, ALBERT, 328, 348, 437, 471, 490, 765
- Robin Hood's Bay, 255
- ROBSON, MAYO, 452
- Rocca di Papa, 169
- ROCHARD, JULES, 73, 682, 765
- Rochefort (Belgium), neighbourhood of, 184
- Rocher de Naye hotel, above Montreux, 152
- Rocky Mountains of North America compared, 137
- Rodenberg brine (at Nenndorf), 553
- RODET, P., 593
- Rodna, 517
- ROEHRIG, 307

- Roemerbad (Styria), 222, **384**
 Roemerquelle (Carinthia), 599, **601**
 ROEMISAH, W., 61, 765
 ROEMPLER, 205
 ROETHLINBERGER, P., 532, 765
 ROHDEN, 588, 766
 Rohitsch (Rohitsch-Sauerbrunn), 223, 322, **486**
 Roisdorf table water, 598
 Roker-on-Sea (Sunderland), 255
 Rolandseck, 188
 ROLOFF, M., 318, 766
 Roman appreciation of thermal springs, 316
 Roman (Irish-Roman) baths, 304, 306
 Romanal water (Lausanne), 599
 Romanshorn (Lake of Constance), 159
 Rome, 169, 236, 291, 293, **289**; malaria in the neighbourhood of, 289; meteorological means for, 236, 289, 291, 293; summer resorts near Rome, 'Castelli Romani', 169
 Roncegno, 216, 321, 524, **529**
 Ronda (Spain), 118
 Ronneburg, 516
 Ronneby, 133, **524**
 Rorschach (Lake of Constance), 159
 Rosbach water, 598
 Roscoe, Sir H. E., 57
 Roscoff, 122
 ROSEMAN, R., 766
 Rosenheim, 432
 Rosenlaur, 149
 Ross, F. W. FORBES, 685
 Ross, G. W., 348, 584, 618, 619, 622, 714, 735
 Rosslare, 26
 Rosstrappe (Unter-Harz), the, 200
 Rostrevor, 260
 Rostrevor sanatorium, 260
 ROTH, H., 534, 535, 553, 766
 ROTH, W., 320, 766
 Rothbury (Northumberland), 276
 Rothenbrunn, 155, **519**, 731, 732
 Rothenburg-on-the-Tauber, 211, 294
 Rothenburg, Wildbad, **211**, 324
 Rothenfelde, 428
 Rothenfels (Black Forest), 195
 Rothesay, 253
 ROTHSCHILD, D., 333, 766
 ROTUREAU, A., 766
 Roucas-Blanc, 445
 Rouen, 294
 Roumania, health resorts of, 230
 Rouzat, 472
 'Royal Hungarian' bitter water, 494
 Royal National Hospital for Consumption at Ventnor, 244, 629
 Royal National Sanatorium for Consumption at Bournemouth, 629
 Royal Sea-Bathing Infirmary at Margate, 238, 630
 Royan, 122
 Royat, 178, 321, 349, **465**, 525, 608, 721, 743
 Rubidium in mineral waters, 323
 Rubinat water, 321, 488, 495
 RUBNER, M., 766
 Rudolfsquelle of Marienbad, 479, 480
 Rudolstadt, 201
 Ruedesheim, 188, 622
 Ruegen, Island of, 128
 Ruegenwalde, 129
 RUGE, H., 17, 636, 766
 Ruhla (Thuringia), 201, 607
 RUMPF, E., 628
 RUMPF, H. T. M., 348
 RUNGE, F., 766
 Ruppertsheim sanatorium, 191, 629
 RUSH, BENJAMIN, 627
 RUNSEL, R., 451
 RUSSELL, E., 422, 757
 Russia, Baltic resorts, and mud baths at, 131, 339
 Russia, Black Sea resorts, and mud baths at, 100, 337
 Russia, inland health resorts of, 271
 'Russian' baths, 304, 306
 RUSSINGER, Abbot of Pfäfers, 375
 RUTHERFORD, W., 341
 Ryde (Isle of Wight), 243

 SAAKE, 28, 32, 57, 329
 Saanen (Gessenay), 156
 SANS-FÉE, 147, 607
 Sables d'Olonne, Les, 122
 SABOURIN, CH., 175, 179, 669
 Sacedon, 170, **397**
 Sadler's Wells (Islington), 504
 Saeckling, 438
 Sacuerling (einfache). See *Table waters*
 Saidschitz water, 225, 320, 489, 494
 Sail-les-Bains, 181, 341, **392**
 Sail-les-Château-Morand. See *Sail-les-Bains*
 Sail-sous-Couzan. See *Couzan*
 SAINSBURY, H., 765
 Saint-Alban (France), 181, 599
 St. Albans, 294
 Saint-Amand, and mud baths at, 183, 337, 338, **387**, 555, 697
 St. Andreasberg (Harz Mountains), **199**, 607
 St. Andrews, 255, 294
 St. Andrew's convalescent home (Folkestone), 240
 St. Anne's Hill 'hydropathic,' at Blarney, 259, 314
 St. Anne's-on-the-Sea, 252
 St. Anne's Well at Buxton, 377
 St. Anne's Well at Malvern, 270, 429
 St. Ann's Well chalybeate water (Brighton), 504
 Saint Antoine-de-Guagno. See *Guagno*
 St. Beatenberg, 142, **149**, 608
 St. Bees, 253
 Saint-Bertrand-de-Comminges, **522**
 St. Blasien, 197, 314, 607
 Saint-Boès, 565
 St. Brelade, Bay of (Jersey), sanatorium, 124
 Saint-Cerques (Swiss Jura), **153**, 160
 St. Chad's Well (London), 504
 Saint-Christau, 177, 321, **604**

St. Donatus spring at Solis, 564
 Saint-Galmier, 181, 321, 599
 St. George's Hill (near Weybridge), 272
 Saint-Germain-en-Laye, 183, 287, 294
 St. Gertraud (Tyrol). See *Sulden*.
 Saint-Gervais-les-Bains and village of
 Saint-Gervais, 171, 491, 608
 St. Goar, 188
 St. Helens (Isle of Wight), 243
 St. Heliers (Jersey), 124
 Saint-Honoré-les-Bains (Nièvre), 181, 321,
 525, 573
 St. Ives (Cornwall), 248
 Saint-Jean-de-Luz, 121
 Saint Jean spring of Vals-les-Bains, 321,
 456, 457, 598
 Saint-Laurent-les-Bains, 392
 St. Lawrence (Ramsgate), 239
 St. Lawrence (Ventnor), 244
 Saint-Léger spring at Pougues, 321, 582,
 592, 593
 St. Leonards (Hastings), 240
 St. Lorenz (Sanct Lorenz) waters, 514,
 468
 'Saint-Louis' spring of Vals-les-Bains,
 531
 St. Luc (Switzerland), high altitude
 resorts near, 147
 Saint-Malo, 122
 St. Margaret's Bay (Kent), 240
 Saint-Mart spring of Royat, 465, 466,
 467
 St. Martin-Lantosque, 173
 St. Martin-Vesubie, 173
 St. Mary's (Scilly Islands), 248
 Saint-Maurice (Vic-le-Comte), 471
 Saint-Mélany, 574
 St. Michael's (Azores). See *San Miguel*
 St. Michael's Home (sanatorium near
 Cheddar), 270
 St. Michael's Mount (Cornwall), Marazion
 by, 247
 Saint-Michel, Mont. See *Mont Saint-*
Michel
 St. Moritz (Sanct Moritz), Bad and Dorf,
 140, 141, 144, 367, 502, 634; St.
 Moritz Dorf, 140; St. Moritz Bad, 502;
 'intermediate' climatic stations for a
 visit to St. Moritz, 141
 Saint-Nectaire, 179, 321, 470, 525, 721
 St. Olafs Bad (Norway), 185, 522
 St. Pancras Well (London), 504
 St. Pancratus sanatorium (Arco), 165
 Saint-Pandélon brine, 393
 Saint-Pardoux spring, near Bourbon-
 l'Arochambault, 439, 600
 St. Peter spring at Vals-am-Platz, 590
 St. Peter spring at Tiefenkasten, 564
 St. Peter's (Thanet), 239
 St. Peter's Port (Guernsey), 124
 St. Petersburg, 285
 Saint-Pierre-de-Chartreuse (France), 173
 Saint-Raphael, 81
 Saint-Roch spring at Bagnères-de-Bigorre,
 582, 591
 'St. Ronan's table water.' See *Inner-*
leithen
 St. Rumbald's Well (Astrop), 504

Saint-Sauveur, 176, 566, 743
 St. Sauveur (Petit) spring at Cauterets,
 539
 Saint-Simon water at Aix-les-Bains, 543,
 599
 Saint-Thomas (French Pyrenées), 574
 Saint-Trojan (Oléron) sanatorium, 122
 Saint-Valéry-en-Caux, 124
 Saint-Vallier, 593
 Saint-Victor spring of Royat, 465, 466,
 467, 525
 St. Wolfgang, Bad (Styria). See *Fusch*
 St. Wolfgang on the Aber-See, 220, 607
 Saint-Yorre (near Vichy), 180, 455
 Sainte-Croix (Swiss Jura), 180, 561
 Sainte-Marguerite, Fontaine, at Mont-
 Dore, 527
 'Saints' Well' at Strathpeffer, 551
 Saki (Crimea) and mud baths at, 100,
 337
 Salcombe, 247
 Salerno, 90
 Sales, 446
 SALES-GRONS, 349, 574
 Salève Mountain, climatic resorts of the,
 153
 Salice, 446
 Salies, Source, at Bagnères-de-Bigorre,
 591
 Salies-de-Béarn, 177, 400, 443
 Salies-du-Salat, 177, 444
 Salignat, 766
 Saline waters, meaning of the term, 325
 Salins (Jura), 181, 442
 Salins-Moutiers (Savoy), 172, 443, 490.
 See also under *Brides-les-Bains*
 Salisbury, 294
 Salò (Lago di Garda), 164
 Salò, the 'Riviera' of, 164
 Salsomaggiore, 167, 446
 Salt, common. See *Sodium chloride*
 Salt-free diet, mineral waters in regard to,
 713
 Salt mud baths. See *Mud baths, salt*
 Saltburn-by-the-Sea, 255, 421, 503;
 brine baths of, 421; chalybeate water
 of, 503
 Salut springs, near Bagnères-de-Bigorre,
 591
 Salutaris water, 302, 597
 SALVA, E., 335
 Salvan (Switzerland), 154
 'Salvator' water of Szinye-Lipocz, 460,
 599
 'Salz' river at Rennes-les-Bains, 520
 Salzbrunn, Bad (Prussian Silesia). See
Obersalzbrunn
 Salzburg (Austria), 219, 294, 607
 Salzburg in Transylvania. See *Vizakna*
 Salzdetfurth, 434
 Salzerbad, 494
 Salzhausen, 210, 426
 Salzkammergut, resorts of the, 219
 Salzquelle of Bad-Elster, 485, 495
 Salzquelle of Franzensbad, 481, 482, 495
 Salzschlirf, 210, 424
 Salzufen, 209, 427
 Salzungen, 202, 349, 427, 510

- 'Salzwasser' of Tarasp, 484
 'Salzwasser' springs of Pyrmont, 508
 Samaden, 142, 144
 San Bernardino, 146, 518
 San Calogero 'stufa,' in Lipari, 578
 San Calogero 'stufa,' in Sicily, 578
 San Dalmazzo-di-Tenda, 167
 San Germano, Stufe di, 472
 San Giuliano, 396
 San Hilario, 461
 San Lucar, 119
 San Marco, 461
 San Martino di Castrozza, 217, 607
 San Miguel (Azores), 116
 San Pedro-do-Sul, 170, 580
 San Pellegrino, 593
 San Pietro-Montagnone, 445
 San Remo, 85, 86, 236, 291; meteorological means for, 85, 236, 291
 San-Salvador sanatorium, near Hyères, 81
 San Sebastian, 119, 121
 'Sanatorium ships' ('Ocean sanatoriums'), 74, 677
 Sanatorium treatment, 416, 588, 625, 630, 662, 668, 672, 680, 699, 725
 Sanatorium treatment at climatic and mineral water health resorts, 416, 625, 627, 668, 672, 676, 680, 699
 Sanatorium treatment for asthma, 588
 Sanatorium treatment for chronic disorders of the digestive system and metabolism, 625, 662, 699
 Sanatorium treatment for chronic tuberculous affections, other than pulmonary, 630
 Sanatorium treatment for epileptics (supervision in 'homes' and 'colonies'), 725
 Sanatorium treatment for pulmonary tuberculosis, 625-630; the main lines of the treatment, 627; literature relating to its methods and results, 628; history of its introduction, 626, 627; sanatoriums for the poorer classes, 629; sanatorium treatment in combination with climatic treatment, 627, 668, 672, 676, 680
 Sanatorium treatment for scrofulous and weakly children, 630
 Sanatorium treatment for various diseases and morbid conditions, 625
 Sanatorium treatment, foreshadowed in Ancient Greece, 613
 Sanatoriums. See under their names in the index
 Sanct Blasien, Sanct Lorenz, Sanct Moritz, &c. See under 'Saints,' *St. Blasien, St. Lorenz, St. Moritz, &c.*
 Sand baths, 340, 426, 472, 560
 Sand (Black Forest), 195
 Sandefjord, 132, 339, 524, 580
 Sandgate (Kent), 240
 Sandown (Isle of Wight), 243
 Sandrock chalybeate water, 504
 Sandsend (near Whitby), 256
 SANDWITH, F. M., 67, 101, 103, 766
 Sangemini water, 599
 Sangerberg, 517
 Sanguinaires islands (Corsica), 94
 SANSOM, A. E., 766
 Santa Agueda, 170, 579
 Santa Catalina sanatorium (Grand Canary), 115
 Santa Catarina (near Dormio), 166, 395, 522
 Santa Cruz (Palma), 116
 Santa Cruz (Teneriffe), 114
 Santa Margherita (Eastern Riviera), 87
 Santander, 119
 Santenay, 491
 Sappey, Le (France), 173
 Sarajevo (Bosnia), 229
 SARAZIN, A., 527
 Sarnthal, the (near Botzen), 245
 Sassnitz (Island of Ruegen), 128
 Satteldüne (Island of Amrum), 137
 Sauerbrunn, Biliner. See *Bilin*
 Sauerbrunn, Giesshuebl. See *Giesshuebl-Sauerbrunn*
 Sauerbrunn, Harzer. See *Harzer Sauerbrunn*
 Sauerbrunn (Pecsenyed), in Hungary, 599, 600
 Sauerbrunn, Rohitsch. See *Rohitsch*
 'Sauerwasser' of Tarasp, 484
 SAUNDY, R., 328, 410, 766
 'Sauvenière' spring near Spa, 499
 SAVILL, T. D., 347, 766
 Savognin, 141, 145, 503
 'Savonneuse' spring at Martigny-les-Bains, 593
 'Savonneuses' springs at Plombières, 388
 Saxon (in Switzerland), 590
 'Saxon Switzerland,' resorts of the, 204
 Scabies and parasitic skin affections, formerly treated by prolonged baths of simple thermal and thermal sulphur waters, 371, 533, 742
 Scandinavian seaside resorts, 132
 Scarborough, 256, 280, 489; meteorological means for, 256, 280; mineral spring of, 489
 SCHAARNER, A., 230
 Schafberg, the (above St. Wolfgang), 220
 SCHALTIN, H., 498
 Schandau, 204, 513
 SCHARRENBROICH, F., 166
 Schatzalp sanatorium, above Davos, 139
 Scheidegg, Little (Switzerland), 149
 SCHENK, 680
 SCHERBAKOV, A., 100, 337, 766
 SCHETELIG, A., 766
 SCHEUER, V., 308, 500, 766
 Scheveningen, 125
 Schierke (Harz Mountains), 199, 607, 609
 Schimberg, Bad, 149, 563
 Schinznach, 160, 439, 559, 582, 743
 SCHIVARDI, P., 10, 767
 SCHLAGINTWEIT, F., 767
 Schlangenbad, 191, 379, 607, 609, 743
 SCHLENKER, 341, 533
 Schleswig Islands, 127
 Schliessee, 213

- Schloss Bürgeln (near Badenweiler), 197
 Schloss Marbach (Baden) sanatorium, 160
 Schloss Weissenstein (Tirol), 217
 Schlossberg (Black Forest), 196
 'Schlossbrunnen' of Karlsbad, 476
 Schluchsee (Black Forest), 198
 Schlucht, the (Vosges Mountains), hotels at, 183
 Schluderbach, 217, 607
 Schmalkalden, 425
 Schmecks (Hungary), 226, 600
 SCHMIDT, A., 620
 Schmiedeberg (Prussian Saxony), 205, 506
 Schmücke (Thuringia), 201
 SCHNÉE, C. E., 303
 SCHNOELLEN, 564
 SCHNYDER, H., 589, 767
 Schoenberg sanatorium (Black Forest), 195
 Schoenau (Bohemia). See *Tepłitz-Schönau*
 Schoenborn-Sprudel, near Kissingen, 415
 Schoenbrunn (Switzerland), 158, 314
 Schoeneck (Saxony), 203
 Schoeneck (Switzerland), 158, 314
 Schoenfels (Switzerland), 158, 314
 Schoenwald (Black Forest), 196
 SCHOTT, A., and SCHOTT, T., of Nauheim, 357, 405, 407, 408, 767. See also *Nauheim treatment*
 Schott 'resistance-exercises' for chronic affections of the heart and circulatory system and indications for the treatment, 357-362, 407-410. See also under *Nauheim treatment*
 'Schott treatment' for chronic affections of the heart and circulatory system. See *Schott resistance-exercises and Nauheim treatment*
 Schrecken (Vorarlberg). See *Schroecken*
 SCHREIBER, 452
 Schreiberhau, 205
 Schroecken (Vorarlberg), 218
 SCHROEDER, G., 60, 61, 676, 757, 762, 767
 SCHROETTER, H. VON, 41, 62, 756, 767
 SCHROETTER, L. VON, 221
 SCHURCKING, A., 767
 SCHUTZE, C., 679, 767
 Schuls (Lower Engadine). See *Tarasp-Schuls*
 SCHULZ, H., 534, 767
 SCHUMACHER, KARL, 773
 Schwabisch Hall. See *Hall in Württemberg*
 Schwalbach, Bad. See *Langenschwalbach*
 'Schwalbach baths.' See *Gaseous iron baths*
 Schwalheimerbrunnen (near Nauheim), 192, 405, 598
 Schwarzbach, 516
 Schwarzeck sanatorium (Thuringia), 201
 Schwarzsee Hotel, above Zermatt, 147
 Schwarzwald. See *Black Forest*
 Schwefelberg, 562
 'Schwefelnatrine' of Rippoldsau, 350, 511
 SCHWEINBURG, L., 300, 767
 Schweiningen. See *Savognin*
 Schweizerhalle, 160, 438
 Schweizermühle, 204, 314
 Sciacca, 522, 578
 Sciatica, 729. See also under *Neuritis and Fibrositis*
 Scilly Islands, and meteorological means for, 248, 280
 Scirocco. See *Sirocco*
 Scotch douche (douche écossaise). See *Douche, Scotch*
 Scotland, inland health resorts, 267
 Scotland, localities for an after-cure to spa-treatment, 609, 610
 Scotland, seaside resorts, 253, 277
 SCOTT, R. IL., 41
 SCOUTETTES, IL., 372
 Scrofula and scrofulous affections, 681
 683; diet in regard to, 683-686; sanatoriums, convalescent homes, and 'rural colonies' for children, 630; open-air education and special schools, 630
 Scutari, 292
 Sea air, characteristics of, 53; therapeutic uses, 55; for scrofulous children &c., 55, 682; sometimes injurious in gouty conditions and in tendencies to 'biliousness' and paroxysmal neuroses, 55, 76, 651, 708; relation to chlorosis, 55; idiosyncrasies towards sea-air, 55. See also under *Climates, marine*
 Sea-bathing, 130, 131, 449-451, 622, 740. See also *Sea-water baths and sea-bathing*
 Sea climates. See *Climates, marine*
 Sea View (Isle of Wight), 243
 Sea voyages. See under *Voyages*
 Sea-water, 449; composition of, 449; a natural mineral water, 449; differences in composition and temperature between different sea-waters, 130, 131, 449, 451; Atlantic, 449, 451; North Sea, 130, 449, 451; Baltic, 130, 449, 451; Mediterranean, 78, 83, 130, 449, 451; Black Sea, 449; Red Sea, 449; internal use of sea-water, 451; external use, 449; sea-water employed for subcutaneous injections, 451. See also *Sea-water baths and sea-bathing*
 Sea-water baths and sea-bathing, 130, 131, 449-451, 622, 740; seasons for sea-bathing, 451; precautions in regard to, 450, 622, 740; danger in regard to aural affections, 740; differences in composition and temperature of sea-waters, 130, 131, 449, 451; sea-bathing on the Baltic coast, 130, 131. See also under *Sea-water*
 Seaford, 242
 Seaside climates. See *Climates, coast*
 Seasons, dry and rainy, 34
 Seasons for sea-bathing, 451
 Seasons for spa-treatment, 354, 367
 Seasons for treatment at health resorts, 16, 354, 367, 451, 609, 634
 Seaton (Devon), 246
 Sebastiansweller, 556

- Sebastopol (Crimea), and mud baths at, 100, 337
 'Seborrhœic eczema,' 743
 Sedlitz and natural Sedlitz water, 225, 489, 495; so-called 'Sedlitz powders,' 225, 489
 SEEGEN, J., 10, 767
 Seelisberg (above Lake of Lucern), 158, 606
 Seeewis (in the Prättigau), 155, 608
 Segeberg, 207, 428
 Selborne (Hampshire), 274
 Selection of climates, &c., in the treatment of pulmonary tuberculosis, 671-678
 Selection of dwellings and rooms at health resorts, 636, 637
 Selection of a health resort, constitution of the patient in regard to, 632
 Selection of a health resort, expense in regard to, 635
 Selection of a health resort, general considerations, 631
 Selection of a health resort, inclinations of the patient in regard to, 635
 Selection of a health resort, opportunities for open-air treatment in regard to, 635
 Selection of a health resort, sunshine and sunlight in regard to, 636
 Selection of a health resort, the journey in regard to, 634
 Selection of a health resort, the season in regard to, 634
 Selection of a locality for an after-cure to spa-treatment, 605
 Selection of health resorts, in various diseases and morbid conditions, 611
 Selters water ('Austrian'), 468
 Selters water (Niederselters), 190, 598
 'Seltzer water,' natural (Selters water, Niederselters), 190, 598; artificial, 351
 'Selzerbrunnen,' near Grossskarben, 598
 Seminal emissions ('nocturnal pollutions'), 719
 Semmering, the, 222
 SEMON, Sir F., 767
 SENATOR, H., 10, 308, 767
 Senility and premature senility. See *Old age and premature senility*
 Sepey, Le (Ormont-dessous), 148
 Serneus, 564
 SEBSIRON, G., 767
 Sestri-Levante, 88
 Sevenoaks and its neighbourhood, 272, 273, 274, 295
 SEVERIN, L., 768
 Seville, 288
 SEWELL, H., 669
 Sexual system, effects of climate on sexual functions and development, 25, 719, 723
 Sexual system in men, disorders of, 718
 Sexual system in women, disorders of, 719
 Shadwell Spa, 504
 Shandon 'hydropathic' (Gareloch), 253
 Shanklin (Isle of Wight), 243; chalybeate water of, 503
 Shap Wells, 548
 SHAW, W. N., 31, 48, 283, 284
 SHEARER, D. F., 653
 Sheerness, 238
 Sharringham, 256
 Sherwood Forest, 275
 Shetland Islands, 133
 Ships specially constructed and arranged for medical purposes to serve as 'ocean sanatoriums,' 74, 677
 Shooters Hill (London), 283, 295
 Shotley Bridge, sanatorium at, 276
 Shotover Hill (near Oxford), 295
 Shrewsbury, 294
 Sicily, 91, 92
 Sidestrand (near Cromer), 257
 Sidlaw Hills Sanatorium, 278
 Sidmouth, 246, 314, 641
 Siebengebirge, the, Petersburg Hotel, 188
 SIEGFRIED, M., 410, 358, 768
 Siena, 169
 Sierre, 154
 STEVEKING, H., 321, 372, 417, 768
 Silicates, alkaline, in simple thermal springs, and their possible action, 341, 533
 Silloth, 253
 Sils Bregaglia, 144
 Sils Maria, 143
 Silvaplana, 144
 Simla, compared, 137
 SIMON, R., 449, 451, 768
 Simoom or simoom wind, 44
 Simple acidulated waters. See *Table waters*
 Simple alkaline mineral waters. See *Alkaline mineral waters, simple*
 Simple gaseous waters, 596. See also *Table waters*
 Simple thermal waters, 317, 321, 324, 329, 331, 332, 340, 341, 370-373, 742; internal use of, 340, 370; external use of, 331, 332, 370-373; radio-activity of, 321, 329, 332, 341, 372; some springs used for ordinary domestic purposes, 317
 Sinala (Roumania), 230
 Sinnbergerquelle at Brückenau, 512, 600
 Sion (Switzerland), 154
 Sipping water, reflex effects of, 341
 Siradan, 592
 Sirmione (Lago di Garda), 165
 Sirocco wind, 44
 Situation and aspect of rooms and dwellings at health resorts, 636, 637
 Situation of a place, influence of, in regard to atmospheric humidity, fogs, rainfall, sunshine, winds, &c. See under *Climate*
 Skegness, 256
 Skin, absorption through the skin, influenced by the state of the skin and by electrolytic action, 304, 332, 333, 658
 Skin affections, 371, 380, 386, 387, 388, 525, 532, 533, 560, 570, 583, 698, 741-744
 Skin affections, arsenical waters in, 525
 Skin affections, parasitic, formerly treated by prolonged baths of simple thermal or thermal sulphur waters, 371, 533, 742

- Skin affections, parasitic, germicidal action of sulphuretted hydrogen in thermal sulphur waters, 532, 533, 742
- Skin affections, simple thermal baths in, 371, 380, 386, 743
- Skin affections, sulphur water baths in, 532, 533, 742
- Skin affections, treatment by prolonged tepid baths, as at Lœdche-les-Bains, 371, 387, 583, 742
- Skin, 'bad circulation,' 698
- Skin, effects of heat and cold on the vascularity of the, 309
- Skin, eruptions from salt or sea water baths; 333, 450; from prolonged tepid baths, as at Lœdche-les-Bains, 371, 387, 583, 742
- Skin, idiosyncrasies towards sunlight, wind, and atmospheric temperature, 742
- Skin, 'ions' of chlorine, &c., made to penetrate through the skin by electrolytic methods, 304, 332, 658
- Skin, 'poussée thermale' at Lœdche-les-Bains and elsewhere. See under *Poussée thermale*
- Skin, 'varicose eczema' and the trophic, cutaneous affections connected with varicose veins, 388, 698
- Skin, 'weakness' of the, 744
- Skodsborg, 132
- Slanic, 230
- SLATER, 62
- Slavonia, health resorts of, 229
- Slavuta (Russia), 232
- Sleep, deficient, 736
- Sleep, disorders of, 736
- Sleep, excessive, 737
- Slivno (Bulgaria), 230
- SMEDLEY, 264, 379
- Smeksz (Hungary). See *Schmecks*
- SMITH, AUGUS, 17, 768
- SMITH, ARCHIBALD, 134, 137, 675, 768
- SMITH, F. W., 304, 332, 768
- SMITH, J. LORRAIN, 62, 640, 698
- Smoke abatement, importance of. See *Smoke and fogs in London and large towns*
- Smoke and fogs in London and large towns, 19, 30, 31, 48, 283, 284
- SNELL, E. H., 41
- Snow, 34
- Snowdon district of Wales, resorts of, 276
- SOBERNHEIM, 685
- Sobron, 603
- SODDY, F., 17, 324, 328, 377
- Soden (Taunus), 192, 423
- Soden-Stolzenberg, 210, 434
- Sodenthal, 210, 431
- Sodium bicarbonate in mineral waters, 325, 344, 452, 463
- Sodium carbonate (bicarbonate) in mineral waters, 325, 344, 452, 463
- Sodium chloride in mineral waters, 325, 343, 463, 713; effects of, 343; in regard to the treatment of renal dropsy, 713
- Sodium chloride, in sea-air, 18
- Sodium chloride solutions, chlorine 'ions' made to penetrate through the skin by electrolytic methods, 304, 332, 658
- Sodium sulphate in mineral waters, 326, 345, 488, 494; comparative table of amounts present in different waters, 494, 495; effects of, 345, 488
- Sodium sulphide in mineral waters. See *Sulphides in mineral waters*
- Sofia (Bulgaria), 231
- Soglio, 145
- Soil, subsoil, and surface of the ground as affecting the climate of a place, 16, 32, 47, 48, 49, 283
- SOKOLOFF, N. N., 473
- Solano wind, 44
- Solbaeder and Sole. See *Soolbaeder and Soole*
- Soldorf, Rodenberg brine from, 554
- Solfatara, the (Pozzuoli), 472
- Solis (Switzerland), 5, 18, 564
- SOLLX, S. E., 10, 33, 35, 60, 116, 137, 628, 669, 672, 676, 680, 731, 768
- Somnolence, excessive, 737
- Sondalo (Valtellina), 166
- Sondrio sanatorium (Valtellina), 166
- Sonnenberg Kurhaus (at Scelisberg), 158
- Sonnenberg, the, above Lucern, 157
- 'Soolbaeder,' 399; meaning of the term Soolbad, 325. See also under *Brine baths and Thermal-Soolbaeder*
- 'Soole,' meaning of the word, 325. See under *Muriated waters and Brine baths*
- Sophienbad (Reinbeck), near Hamburg, hydrotherapy, 314
- Sorrento, 89
- Soultz-les-Bains. See *Sulzbach*
- Soultzbach. See *Sulzbach*
- Soultzmatt. See *Sulzmatt*
- South Africa, visits to, 70
- South African high altitude resorts, compared, 137
- South American high altitude resorts, compared, 137
- South Downs (England), 272
- Southampton, 243, 294
- Southborough (near Tunbridge Wells), 268
- Southbourne-on-Sea, 245
- Southend-on-Sea, 257
- Southgate (London), 284
- Southport, 252
- Southsea, 243
- Southwold (Suffolk), 257
- Spa (Belgium), 183, 299, 498; the chalybeate springs in Spa, 498; those in the neighbourhood, 499
- 'Spa,' English use of the word for any mineral water health resort, 227, 299, 498
- Spa-treatment, 'accessory' (treatment at spas in addition to that by the mineral or thermal waters), 356
- Spa-treatment, associated therapeutic factors, 352-362, 613, 631, 635
- Spa-treatment, careless use of mineral waters, 866

- Spa-treatment, climate, situation and surroundings of spas in regard to, 353
- Spa-treatment, constitution of the patient in regard to the selection of health resorts, 632
- Spa-treatment, daily life at spas, 364, 467, 478, 499, 528, 539, 544, 587; daily life at Karlsbad in Bohemia, 478; daily life at French spas, 390, 467, 528, 539, 544, 587; daily life at Spa in Belgium, 499
- Spa-treatment, diet in connection with, 615. See also under *Diet*.
- Spa-treatment, duration of the 'cure,' 365
- Spa-treatment, effects of, vary much in different individuals, 534. See also under *Constitution of the patient*
- Spa-treatment, importance of an 'after-cure' (Nach-Kur), 355, 368, 727
- Spa-treatment, influence of altered mode of life in, 355
- Spa-treatment, influence of 'change of air' and changed surroundings in visits to health resorts, 352, 631
- Spa-treatment, inhalation, pulverisation and sprays of mineral waters, 349, 464, 528, 532, 537, 539, 543, 554, 572, 574, 588, 604, 689
- Spa-treatment, journey to the health resort, precautions in regard to, 354, 616, 617, 634; special danger in cardiac disorders when compensation is commencing to fail, 407, 409, 694
- Spa-treatment, localities for an 'after-cure' to, 605. See also under *After-cure*
- Spa-treatment, massage and active and passive exercises in connection with treatment at health resorts, 356, 614. See also under *Massage and Exercises*
- Spa-treatment, medical supervision at health resorts and importance of local medical advice. See *Medical supervision at health resorts*
- Spa-treatment, open-air treatment in connection with, 352, 353, 356, 635
- Spa-treatment, ordinary pharmaceutical and surgical treatment in connection with, 356, 585. See also *Surgical treatment in connection with treatment at health resorts*
- Spa-treatment, 'poussée thermale' or 'well-fever,' 361, 366. See also under *Poussée thermale*
- Spa-treatment, preparatory treatment to, 368
- Spa-treatment, psychical influences in treatment at health resorts, 354, 613, 614. See also under *Mental factor*
- Spa-treatment, rest and recreation at health resorts, &c., 281, 354, 355, 613, 631
- Spa-treatment, sanatorium treatment at health resorts, 416, 625, 699
- Spa-treatment, seasons for, 354, 367, 634. See also *Seasons for treatment at health resorts*
- Spa-treatment, selection of health resorts, 631. See also under *Selection of a health resort*
- Spa-treatment, specialisation of spas, 363
- Spa-treatment, therapeutic indications, 611. See also under *Selection of a health resort*, and under the names of the various diseases and morbid conditions
- Spa-treatment, use of mineral water after leaving the spa, 368
- Spain, coast of, 117
- Spain, inland health resorts, 169
- Spain, purgative waters of. See *Rubinat, Condal, Carabana, and Villacabras*
- SPARKS, E. I., 79, 768
- Specialisation of spas and health resorts, 363
- SPEED, 451
- SPENGLER, A., 138, 139, 768
- SPENGLER, C., 768
- SPENGLER, J., 672, 676, 768
- SPEYER, 294
- Spezia, 88, 236
- Spinabad, 140
- Spinal cord affections, 371, 724, 728; chronic results of myelitis, 724
- Spindelmühl, 205
- Spital-am-Semmering, 222
- Spitzbergen, 133
- Spuegen, 145
- Spondylitis deformans (chronic ossifying), 657
- Sprays of mineral waters, 349. See also *Inhalation, pulverisation and sprays of mineral waters*
- 'Sprudel' spring of Karlsbad, 321, 322, 476, 495
- 'Sprudel' springs of Nauheim, 406
- 'Sprudelstrom' bath of Nauheim, 406
- SQUIRE, J. E., 630, 768
- SQUIRE, M. F., 622
- Srebrenica, 524, 530
- Ssaki. See *Saki*
- Stabiae. See *Castellammare-di-Stabia*
- Stachelberg, baths of, 158, 564
- Stafford, 265, 421, 503
- Staines (Thames), 271
- Stanserhorn, 150
- Starnberg, 213, 607
- Steben, 202, 512
- STEGMANN, R., 418, 768
- Steinach (Tirol), 218
- STEINDÜCHEL, VON, 658
- STEMMLER, 574
- Stephaniequelle of Franzensbad, 481
- STEPHENS, G. A., 698
- Sterility, 465, 497, 499, 722
- STERN, B. A. P., 535, 553, 768
- Sternberg, 517
- Sterzing (Tirol), 218
- Stettin chalybeate spring, 516
- STIFFT, H., 534, 535, 553, 768
- 'Stinkberg' of Torja. See *Torja Stinkberg*
- STINTZING, R., 768
- Stoberhey (Harz), 199, 200
- Stockholm, 285
- STOCKMAN, R., 346

- STOECKER, A., 585, 768
 STOKES, WILLIAM, 358, 695
 STOKER, G., 336
 Stomach, chronic catarrh and chronic disorders of, 400-403, 452, 474, 478, 562, 582, **699-704**; internal use of muriated waters in, 400-403, 702, 703; internal use of alkaline waters in, 452, 702; internal use of sulphated waters in, 702, 703
 Stomach, conditions of deficient motor activity, 702
 Stomach, conditions of excessive and deficient hydrochloric acidity, 703
 Stomach, disorders of, diet in regard to the internal use of mineral waters, 403, 474, 478
 Stomach, experiments of Bickel and others regarding the local action of mineral waters when taken internally, 401-403, 702, 703
 Stomach, influence of radio-active waters on pepsin digestion, 329, 341, 703
 Stomach, influence of the osmotic pressure of mineral waters on the, 342, 488, 702
 Stone in the bladder. See under *Urinary bladder*
 Stone in the gall-bladder. See under *Cholelithiasis*
 Stone in the kidney. See under *Urinary calculi*
 Stonehaven, 254
 Stoney-Middleton, 264, **379**
 Stow, Bond, 626
 Strassburg, 286, 294
 STRASSER, A., 301, 307, 308, 660, 761, 768, 769, 773, 774
 Strathpeffer Spa, 267, 280 (meteorological means), 551
 Strathspey, resorts of, 278, 279
 STRAUSS, H., 319, 320, 342, 403, 658, 702, 766, 769
 STRAUSS, J., 583
 Strawberries, therapeutic use of, 622
 Streatham water, 489
 Streitberg (Franconian Switzerland), 203
 Stressa, 161
 Stroemstad, **132**, 580
 Stronachlacher (Loch Katrine), 277
 STRUEVE, 360
 Strunga, 230
 STRUTT, Hon. R. J., 328, 377, 449, 599
 STRUYE, F. A. A., 351
 Stubbenkammer (Island of Ruegen), 128
 Stubnya, 385
 Stuer, Bad, **208**, 314
 'Stufe.' See *Vapour baths, natural*
 STURGE, W. A., 81, 82, 410, 769
 STURM, Ad., 426
 Stuttgart, 286, 287
 Styria, resorts of, 222
 'Styriabrunnen' of Rohitsch, 487
 Suakin, temperature records, 102
 SUCHARD, A. F., 769
 Suderode (Unter-Harz), 200, 434
 Sudetic Mountains, health resorts of the, 204
 Suffolk, coast of, 257
 Sulden (Tirol), **217**, 606
 Sulis water (Bath), 350, 377
 Sulphate of iron baths, 497
 Sulphate of iron waters, 503, 504, 523
 Sulphate of iron waters, arsenical, **528-531**
 Sulphate of magnesium in mineral waters. See under *Magnesium sulphate*
 Sulphate of sodium in mineral waters. See under *Sodium sulphate*
 Sulphated-alkaline waters, 325, 345, **474**, 478; effects of internal use of, 345; diet in regard to the internal use of, 474, 475, 478
 Sulphated mineral waters, 320, 326, 342, 345, **488**; table of analyses of, 494, 495; effects of internal use of, 345; doses of, 495; explanation of the purgative action of, 342, 488
 Sulphated mineral waters, muriated. See *Muriated-sulphated waters*
 Sulphated mineral waters of England, 489
 Sulphates, purgative, in mineral waters. See *Sulphated mineral waters* and *Muriated-sulphated waters*
 Sulphide of sodium waters, 326, 536. See also under *Sulphur waters*
 Sulphides in mineral waters, 326, 347, **532-536**; chemical changes on exposure of sodium sulphide waters to air, 536; effects of sulphide-containing waters, 532 to 535; artificial removal of sulphides from mineral waters for therapeutic purposes, 350, 351, 547
 Sulphur mud baths. See *Mud baths, sulphurous*
 Sulphur water baths and douches, 532; electrolytic methods employed with sulphur water baths, 304, 352, 768
 Sulphur waters, 326, 350, **532-536**, 742; various subdivisions of the class, 536
 Sulphur waters, artificial removal of sulphides from muriated sulphur waters, &c., 350, 351, 547
 Sulphur waters, 'degenerated,' 536
 Sulphur waters, experiments in regard to the action of, 532-535, 546, 547
 Sulphur waters, external use. See *Sulphur water baths and douches*
 Sulphur waters, germicidal action of, 532, 533, 742
 Sulphur waters, internal use of, 347, **534**
 Sulphur waters, muriated, 536. See also under *Sulphur waters*
 Sulphur waters, rapid alterations in, and disadvantages of bottled sulphur waters, 535, 536
 Sulphur waters (thermal), glairine, barégine and living organisms in, 326
 Sulphuretted hydrogen gas baths, 336. See also *Sulphurous vapour baths, natural*
 Sulphuretted hydrogen gas, inhalation of, 350, 554. See also *Sulphurous vapour baths, natural*

- Sulphuretted hydrogen gas in mineral waters, 323, 333, 347, **532-536**; germicidal action of, 532, 533, 742
- sulphuretted hydrogen gas in the water of baths, 333, 532, 533, 742; germicidal action of, 532, 533, 742
- Sulphuretted hydrogen waters, 536. See also *Sulphur waters*
- Sulphuric acid, free, in mineral waters, 323; in sea-water, 323
- Sulphurous mud baths. See *Mud baths, sulphurous*
- Sulphurous vapour baths, natural, 331, 332, 517, 592
- Sulza, 427
- Sulzbach (Alsace), 516
- Sulzbach (Baden) 385
- Sulzbad (Alsace), 433
- Sulzbrunn, 213, **433**
- Sulzmatt (Alsace) table water, 598
- Summer rashes, 29, 742
- Sun baths, 223, 352, **353**
- Sun erythema, 29, 742
- Sun urticaria, 29, 742
- Sunburn, 29
- SUNDERLAND, S., 719
- Sunlight, 27-31. See also under *Sunshine*
- Sunlight, effects of, 'chemical' (ultra-violet) rays, 28, 57, 742
- Sunlight, increase of 'chemical' (ultra-violet) rays at high altitudes, 28, 57
- Sunninghill spring, 504
- Sunshine and sunlight, 27 to 31
- Sunshine and sunlight, importance of latitude in regard to winter insolation for invalids, 635
- Sunshine and sunlight, in regard to the selection of a health resort, 635, 636
- Sunshine and sunlight, loss of, in London and large towns owing to smoke and fogs, 30, 31, 48, 283, 284
- Sunshine, duration of, actual, 29; possible, 29, 635
- Sunshine, effects on the eyes, 29, 738
- Sunshine, effects on the skin, 29, 742
- Sunshine recorders, 29
- Sunshine records compared, 29-31, 234, 280
- Sunshine records in the British Islands, 233, 234, 280
- 'Suotsasso' spring of Tarasp-Schuls, 484
- Surbiton, 271, 295
- Surface of the ground as affecting the climate of a place, 32, 47, 48, 50
- Surgical treatment in connection with treatment at health resorts, 57, 356, 389, 585, 683, 710; at mineral water resorts, 356, 585
- Surpunt-quelle of St. Moritz, 502
- SUTER, F., 60, 61, 751
- SUTRO, S., 769
- Swanage, 245
- Swanlinbar (Swanlibar), 280, **553**
- Swedish gymnastics in connection with treatment at health resorts, 314, **357**, 361, 362; in connection with hydrotherapy, 314. See also under *Exercises, active and passive*
- Sweden, inland resorts of, 185
- Sweden, seaside resorts of, 132
- Swimming as a therapeutic form of exercise at health resorts, 315, 360, 614
- Swinemünde, **129**, 180, 131
- Switzerland, climatic resorts of the Swiss lakes, 150, 157, 158, 159
- Switzerland, high altitude resorts, 134; winter at, 135; summer at, 136, 143; winter sunshine at, 135; summer resorts, 142; winter resorts, 134
- Switzerland, resorts of low and moderate elevation, 150
- SYDENHAM, THOMAS, 627
- Sydenham, Upper (London), and Sydenham Hill, 284, 295
- Sydenham Wells, 489
- Sylt, 127
- Sylvanès, 392, 522, **531**
- SYMONDS, J. A., 134
- Syphilis, 533, 542, 571, **647-650**, 714, 722, 725; in regard to organic affections of the nervous system, 725; in regard to the habit of abortion, 722; in regard to Raynaud's disease and paroxysmal hæmoglobinuria, 714; syphilitic cachexia, 650
- Syracuse, 91
- SZABOKY, J. VON, 342, 343, 468, 769
- Szczawnica, 227, **469**
- Szinye-Lipocz (Salvator water), **460**, 599
- Szkleno, 228, **589**
- Szliacs, 228, **515**
- Szobrancez, 227, 557
- TABARZ (Thuringia), **201**, 607
- Tabes dorsalis, 371, 423, 520, **728**; Frenkel's exercises for the muscular inco-ordination, 728
- Tabiano, 167, **577**
- Table waters, 327, 343, **596**
- Table waters, artificial, known purity of some, 597
- Table waters, bottled natural table waters sometimes useful on account of their known purity, 597
- Table waters, different classes of, 597
- Table waters, earthy group of, 597
- Table waters 'mixed bicarbonates' in, 597
- Table waters, muriated-alkaline group of, 597
- Table waters, precautions in the internal use of gaseous waters, 343, 597
- Table waters, simple alkaline group of, 597
- Table waters, use and abuse of, 343, 597
- Tachycardia and palpitation, 696; in connection with Graves's disease, 696
- 731
- Tacoronte (Teneriffe), 115
- Tallerman local hot-air baths, 305, 306
- Tambach (Thuringia), 201
- 'Tambour' spring of Barèges, 566
- Tangier, 110
- Taormina, 91
- Taplow (Thames), 271

- Tarasp. See *Tarasp-Schuls*
 Tarasp-Schuls, 144, 320, **483**, 517, 609
 Tarcsa, 517
 Tasmania, visits to, 72
 Tassilloquelle (Haller Iodwasser), **435**, 731
 Tatra-Barlangliget, 227
 Tatra-Fuered. See *Schnecks*
 Tatra-Hoehlenhain, 227
 Tatra Mountains, health resorts of the, 226
 Tatrachaza, 227
 Tatzmannsdorf. See *Tarcsa*
 Taunus Mountains, health resorts of, 190
 Taunusquelle, near Grosskarben, 598
 Taormenium. See *Taormina*
 Tausz, B., 320
 TAYLOR, H. COUPLAND, 769
 Tcham-Korya (Bulgaria), 231
 Tchokrak (Crimea), 100
 Teddington, 271, 295
 Tegernsee, **213**, 607
 Teignmouth, 247
 Teinach, 195, 314, **512**, 598, 607, 609
 Teissières-les-Bouliès, 598
 Telangiectases induced by exposure to sunshine, 29
 Telese, 472
 'Tempelbrunnen' of Rohitsch, 487
 Temperature, atmospheric, 20
 Temperature, atmospheric, absolute annual range, 22
 Temperature, atmospheric, daily range, 22
 Temperature, atmospheric, in large towns, 'city temperatures,' 48
 Temperature, atmospheric, influence of, 25; in regard to diseases and morbid conditions, 25, 26, 27
 Temperature, atmospheric, monthly and seasonal ranges, 22, 23
 Temperature, atmospheric, so-called annual range, 22
 Temperature, atmospheric, table of temperature means for British resorts, 280
 Temperature, atmospheric, table of temperature means for Italian resorts, 291
 Temperature, atmospheric, table of temperature means for large towns of Europe and North Africa, 293
 Temperature, atmospheric, table of temperature means for well-known winter resorts, 236
 Temperature of baths and douches, 303, **305**, 306
 Temperature of thermal and mineral springs, 317
 Tenby, 250
 Teneriffe, **113**, 236
 Tennstedt, 556
 Teplitz, meaning of the word, 227. See *Teplitz-Schönau*, *Trencsin-Teplitz*, *Warasdin-Teplitz*, and *Krapina-Teplitz*
 Teplitz-Schönau, 225, 322, **383**
 Tercis, 574
 Termini-Imerese, 92, 367, **447**, 634
 'Terrain-Cur,' **358**, 359, 361, **614**, 701; health-resorts suited for, **358**, 614
 Territet, **150**, 622
 'Test action' of sulphur water baths in syphilitic cases, 533
 'Test action' of thermal baths in gouty conditions, 360
 Teutoberger Wald, resorts of the, 208, 209
 'Tewit Well' of Harrogate, 546
 Thale (Unter-Harz), 200, **429**
 Thalheim at Landeck in Prussian Silesia (hydrotherapy), 381
 Thames, resorts on the, 271
 Thames Ditton, 271
 THAN, KARL VON, 229
 Thanet, 'Isle of,' climate and health resorts of, 238, 239
 Tharandt (Saxony), 204
 THAYER, 308
 Theophilquelle at Passugg, 600
 Therapeutic indications. See *Indications*
 Thermæ Euganeæ. See under *Euganean Hills (Italy)*
 Thermæ Herculis. See *Hercules-Bad*
 Thermæ Himerenses. See *Termini-Imerese*
 Thermæ Jasæ. See *Warasdin-Teplitz*
 Thermæ Pannoniæ. See *Attenburg*
 Thermæ Sellinuntinæ. See *Sciaccia*
 'Thermæ silvestres,' 324
 Thermal baths of various kinds. See under *Baths*
 Thermal mineral waters. See under the various classes of mineral waters
 'Thermal-Soolbaeder,' 325, 334, 351, 400, **407**, 423, 424, 695. See also *Nauheim treatment*
 'Thermal-Soolbaeder,' artificial, 334, 351, 695
 Thermal waters, simple. See *Simple thermal waters*
 THERMES, 308
 Thermopylæ, 580
 Thermotherapy, meaning of the word, 300; reactions of the body to cold and heat, 306-312; thermotherapy in pulmonary tuberculosis, 680
 THILENIUS, G., 756
 THILENIUS, O., 769
 THIN, G., 618, 734
 THIROUX, H., 338, 388, 697, 769
 THISSEN, J., 773
 THOMPSON, E. SYMES, 123, 246, 769, 773
 THOMPSON, W. H., 734, 764
 THOMSON, D., 628
 THOMSON, J. J., 322, 329
 Thonon, 153, 599, **602**
 Thorax, increase in measurements at high altitudes, 59, 690
 Thorenc, 173
 Thorium in deposits from mineral waters, 340, 411
 THORNE, L. C. THORNE, 769
 THORNE, W. BEZLY, 407, 769
 Thorp Arch or Boston Spa (Yorkshire), 421
 Three Bridges, 274

- Throat, affections of. See under *Pharynx*
 Thuez (Olette), 570
 Thun and Lake of Thun, 156, 609
 Thuringian Forest (Thüringer Wald), resorts of, 200
 Thusis, 155, 608
 Thyroid gland, disorders of. See *Goitre*, *Graves's disease*, and *Myxædema*
 TICHBORNE, C. R. C., 757
 Tiefenkasten (Tiefenkastell), 155, 518, 564
 Tighir-Ghiol lake (Roumania), 230
 Tigvele, Mt. (Roumania), 230
 Timbercombe sanatorium, 270
 Tintagel (Cornwall), 248
 TROLL, L., 769
 Tirol, health resorts of, 214
 TRISCHLER, H., 713
 TRASSLER, P. L., 41, 769
 Titisee (Black Forest), 198, 607
 'Tivoli' douche. See *Douche Tivoli*
 Tobelbad (Styria), 222, 364
 Toblach (Pusterthal), 217
 Todtmoos, 197, 607
 Toelz. See *Krankenheil-Toelz*
 Toennistein, 189, 467, 598, 600
 Toeplitz. See under *Teplitz*
 Toeplitz bei Neuhaus. See *Neuhaus (Styria)*
 Tofte Høilids-Sanatorium (Norway), 185
 Tomintoul (Scotland), 279
 Tonicity of Mineral waters. See under *Osmotic pressure*
 'Tonnetet' spring near Spa, 499
 Tonsaasen sanatorium (Norway), 185
 Topusko, 229, 385
 Torino. See *Turin*
 Torja 'Stinkberg' (Torjai büdös), 517
 Torquay, 236, 246
 Torre del Greco, 90
 Torrentalp Hotel (Switzerland), 148
 Toso, A., 576
 Totland Bay (Isle of Wight), 244
 Totteridge, 284
 Touquet, Le, 125
 Touring. See *Travelling as a therapeutic agent*
 Tours (France), and the country of the Loire, 294
 Towns, large and interesting, therapeutic use of visits to, 281, 293, 667, 727
 Towns, large, artificial factors in the climates of, 30, 31, 48, 282, 283
 Towns, large, 'city' temperatures, 48
 Towns, large, meteorological means for great towns of Europe and North Africa, 236, 291, 293
 Towns, large, smoke and fogs of, 30, 31, 48, 283, 284
 Towns, large, the great cities of Europe, 281
 Towyn (Cardigan Bay), 250
 TRACY, S. G., 769
 Trade winds, 40, 43
 Trafoi (Tirol), 217, 606
 Tralee Spa (Ireland), 259, 504
 Tramezaignes, 574
 Tramore, 261
 Transylvania, health resorts of, 227
 Traunstein, 213, 433
 Travelling as a therapeutic agent, 186, 281, 293, 354, 631, 632, 667, 700, 726; in old age, 632, 667; in some dyspeptic conditions, 700; after mental overwork and 'brain-fag,' 281, 726
 Travelling, danger of, in cardiac disorders when failure of compensation is threatened, 407, 409, 694
 Travelling, digestive disturbances, biliousness and diarrhœa, in connection with travelling, 616
 Travelling, maintenance of health during, 617
 Travelling to health resorts, precautions in regard to, 634. See also under *Journey to health resorts*
 Travemünde, 128
 TRAVERS, M., 324
 Trefriw, 268, 277, 504; chalybeate water of Trefriw Wells, 504
 Tregenna Castle Hotel (St. Ives, Cornwall), 248
 Tréguier, 122
 Tregurrian Beach (Cornwall), 248
 Tremblade, La, 122
 Tremezzo (Lago di Como), 163
 TRÉMOLIÈRES, F., 706
 Trencsin-Teplitz, 228, 558
 Trent (Trient), 216
 Trentsclin-Teplitz. See *Trencsin-Teplitz*
 Tréport, Le. See *Tréport-Mers*
 Tréport-Mers, Le, 124
 Tresco (Scilly Islands), 248
 Trespoey sanatorium (Pau), 177
 Treves (Germany), 294
 Triberg (Black Forest), 196
 Tricycle, use of for graduated active and passive exercises ('cyclotherapy'), 358, 410
 Trient. See *Trent*
 Trier. See *Treves*
 Trieste, 96
 Trillo (Spain), 170, 448
 Triquent, 154
 Trogen (Appenzell), 159
 Troisième, La, spring near Bourbon-l'Archambault, 439
 'Tropical' anæmia. See *Anæmia, tropical*
 'Tropical' liver disorders, 477, 708
 Trossachs, the, 277
 Trouville, 124
 TRUDEAU, E. L., 769
 Tuberculosis, articular and osseous, 681, 683
 Tuberculosis, chronic tuberculous affections, other than pulmonary, 681
 Tuberculosis, cutaneous, 741
 Tuberculosis, glandular. See under *Lymphatic glands*
 Tuberculosis, laryngeal, influence of climate in, 672; significance in regard to the climatic treatment of pulmonary tuberculosis, 672
 Tuberculosis, pulmonary, 75, 540, 569, 579, 588, 590, 625-630, 668-681, 683-686

- Tuberculosis, pulmonary, arrested cases, 674
- Tuberculosis, pulmonary, associated with asthma, 674
- Tuberculosis, pulmonary, children with a tendency to, and their education, 630, 682
- Tuberculosis, pulmonary, climatotherapy in, 669-678; climatic methods of treatment in ancient times, 668; influence of the various climatic factors, 669; selection of climates, 671-678; statistics of climatic treatment, 675-678; climatic treatment in combination with sanatorium treatment, 627, 668, 672, 676, 680
- Tuberculosis, pulmonary, constitution of the patient in regard to the selection of climates, 671
- Tuberculosis, pulmonary, 'desert climates' in, 678
- Tuberculosis, pulmonary, diet in regard to, 683-686
- Tuberculosis, pulmonary, general hygienic methods in the treatment of, 680. See also *Sanatorium treatment for pulmonary tuberculosis*
- Tuberculosis, pulmonary, high altitudes in, 675-677
- Tuberculosis, pulmonary, hydrotherapy in, 678-680
- Tuberculosis, pulmonary, importance of State control and universal insurance of the working classes in the fight against tuberculosis, 630
- Tuberculosis, pulmonary, influence of the various climatic factors in, 669
- Tuberculosis, pulmonary, influence of winds in regard to, 47, 673, 680
- Tuberculosis, pulmonary, local hyperæmia as a method of treatment, 679, 680
- Tuberculosis, pulmonary, medical supervision, importance of, 680, 681
- Tuberculosis, pulmonary, mineral water health resorts in, 540, 569, 579, 588, 590, 675, **678**
- Tuberculosis, pulmonary, need of homes for advanced and hopeless cases, 630
- Tuberculosis, pulmonary, open-air exercise in regard to the prevention of, 626
- Tuberculosis, pulmonary, open-air treatment, 626, 668. See also *Sanatorium treatment for pulmonary tuberculosis*
- Tuberculosis, pulmonary, sanatorium treatment, **625-630**, 668, 672, 676, 680. See also *Sanatorium treatment for pulmonary tuberculosis*
- Tuberculosis, pulmonary, sanatorium treatment in combination with climatic treatment, 627, 668, 672, 676, 680
- Tuberculosis, pulmonary, sanatoriums for the poorer classes, 629
- Tuberculosis, pulmonary, sea-voyages in, 75, **677**
- Tuberculosis, pulmonary, selection of climates in, 671-678
- Tuberculosis, pulmonary, significance of laryngeal tuberculosis in regard to the climatic treatment of, 672
- Tuberculosis, pulmonary, statistics of climatic treatment, 675-678
- Tuberculosis, pulmonary, 'Stauungstherapie' and 'thermotherapy' in, 679, 680
- Tuberculosis, pulmonary, 'zomotherapy' in regard to, 685
- Tueffer (Styria), 222, **384**
- Tummel Bridge, 278
- Tunbridge Wells, 268, 272, 280, **503**; meteorological means for, 280
- TUNNICLIFFE, F. W., 359, 361, 748
- TURBAN, K., 61, 139, 198, 638, 663, 676, 770, 774
- Turban's sanatorium at Davos, 139
- Turbie, La (near Monaco), 84
- Turin, 290; meteorological means for, 291
- Turkish baths, 304, 305, 306
- Tusnad, 517
- TUSSIGNANA, PETRUS DE, 394
- Twannberg, Kurhaus, 160
- Twickenham, 271, 295
- TYLER, W. F., 52
- TYNDALL, J., 19
- Tynemouth, 255
- Typhlitis. See *Appendicitis*
- Tyrol. See *Tirol*
- UEBERLINGEN (Lake of Constance), 159
- Uetliberg, above Zurich, 159
- Ulcers, chronic, 370, 371, 566
- Ullersdorf (Gross-Ullersdorf), 207
- Ullswater, 276
- Undercliff of the Isle of Wight, 164
- UNGER, F., 138, 403, 770
- University towns, visits to, 294, 295
- Unter-Harz, resorts of the, 200
- Unter-Schmecks, 227
- Unterach (Attersee), 220
- Unterengadin. See *Engadine, Lower*
- Untermais (Meran), 214
- Urberoaga-de-Alzola, 170, **397**
- Urberoaga-de-Ubilla, 397
- Urethritis, chronic, 717
- Urethritis, gouty, 717
- 'Uriage baths,' artificial, 442
- Uriage-les-Bains, 172, 321, 357, 443, 526, 570, 648, 730, 743
- Uric acid sand and gravel. See *Urinary (uric acid) sand and gravel*
- Urinary bladder, calculi, 583, 714, **716**
- Urinary bladder, chronic catarrh, 583, 586, **717**; action of earthy mineral waters, 583
- Urinary bladder, gouty cystitis, 717
- Urinary calculi, 583, 714, **716**
- Urinary gravel. See *Urinary (uric acid) sand and gravel*
- Urinary lithiasis. See *Urinary calculi*
- Urinary organs, diseases of, 583, 585, 586, 594, **712-717**. See also *Urine, abnormalities of*
- Urinary (uric acid) sand and gravel, 341, 400, 452, 463, 468, 469, 583, 586, **714**;

- action of muriated and muriated-alkaline waters, 341, 400, 463, 468, 469, 715; action of calcareous salts and earthy mineral waters, 588, 715; solvent action of alkaline mineral waters, 452; solvent action of alkaline silicates in mineral waters, 341
- Urine, abnormalities of. See *Albuminuria*, *Hæmoglobinuria*, *Glycosuria*, *Phosphaturia*, *Oxaluria*, and *Urinary (uric acid) sand and gravel*
- Urine, nocturnal incontinence of, 587
- Urticaria, chronic, 748
- Usedom, Island of, 129
- Ussat, 175, **394**
- Uterus and annexes, chronic inflammatory conditions of, 721. See also under *Pelvic organs in women*
- Uterus, chronic congestion with menorrhagia, 719, 721
- Uterus, chronic diseases of, 389, 412, 419, 444, 567, 719, **721**. See also under *Pelvic organs in women*
- Uterus, fibroid tumours (fibromyomata) of, associated with menorrhagia, 412, 419, 444, 719, **722**
- Uterus, subinvolution of, with chronic congestion, 719, 721
- VAJNAFALVA**, 469
- Val-Mont sanatorium (Montreux), 152
- Val Sinestra water, 144, 484, 518, **530**
- Val Sugana resorts, 528, 529
- Valdagno. See *Vegri di Valdagno*
- Valders district (Norway), 185
- Valdieri, 167, **396**, 576
- Vale of Clwyd Sanatorium (Wales), 277
- Valencia (Spain), 117
- Valencia (Valentia), Ireland, **259**, 280
- Valens (near Ragatz), 156
- Valentia. See *Valencia*
- VALENTINER, T., 10, 770
- Valescure, 81
- Vallespir, the (Amélie-les-Bains), 174
- Valetta, 94
- Vallombrosa (Apennines), 169
- Vals-am-Platz (Switzerland), 146, **590**
- Vals-les-Bains (France), 180, 321, **456**, 524, 531, 598; cold alkaline waters, 456; sulphate of iron waters, 531; weakly mineralised springs used as table waters, 598
- Valvular diseases. See under *Heart*
- VANDEWEYER, E., 367, 496, 770
- Vapour baths. See *Hot air and hot vapour baths* and *Vapour baths, natural*
- Vapour baths, natural, **331**, 332, 395, 472, 517, 576, 578, 589, 592; with sulphuretted hydrogen (natural sulphurous vapour baths), 331, 332, 517, 592
- Varallo, 166
- Varese, **162**, 609
- 'Varicose eczema' and the trophic cutaneous affections connected with varicose veins, 388, 698
- Varicose veins. See under *Veins*
- Varna (Bulgaria), 231
- Vegetation, influence of, on the atmosphere and climate of a locality, 16, 49, 50
- Vegri di Valdagno water, 522, 530
- VEILLON, E., 60, 751
- Veins, tendency to phlebitis, 697
- Veins, varicose, 388, **697**
- Vejle fjord sanatorium (Denmark), 182
- Velden (Wörther See), 223
- Veldes, **223**, 352, 385, 636
- Vellach (Carinthia), 517
- Venice and meteorological means for, **94**, 236, 291, 637
- Vent (Oetzthal Alps), 218
- Ventilation of bath-rooms, &c., **305**
- Ventimiglia, 85
- Ventnor, and meteorological means for, **236**, **243**, 280
- VERAGUTH, C., 770
- VERDAT, E., 562, 770
- VERDENAL, 532
- Vergèze springs, 599
- VÉRITÉ, A., 770
- Vernet-les-Bains (Le Vernet), **175**, 569
- Verneuil sanatorium (La Baule), 122
- Vernex, 150
- Vernière, Source de la (near Lamalou), **519**, 600
- Versailles, 183
- Vesical diseases. See *Urinary bladder*
- Vetriolo (above Levico), 216, **528**, 529
- Vevey, **152**, 609, 622
- Veytaux, 150
- Viareggio, 88
- VIAULT, F., 60, 770
- Vic-le-Comte, 471
- Vic-sur-Cère, 472, 522, **531**
- Vicarelo, 397
- Vicar's Bridge chalybeate spring, near Dollar, 504
- Vichy, 180, 321, 357, **453**, 526, 708, 710
- Victoria Hospital, Craigleith (Edinburgh), 629
- Victoria Spa, 489
- Vidago (Portugal), 170, **462**, 715
- Viège. See *Visp*
- Vienna, 286, 287, 293; meteorological means for, 293
- 'Vierzellenbad,' 303
- Vigo-di-Fassa (Tirol), **217**, 607
- Vigo (Spain), 119
- Vihnye, 228, **515**
- Vilaflor (Teneriffe), 115
- Villa (Bagno di Lucca), 168, **594**
- Villa Carlotta (Lago di Como), 163, 236
- Villa d'Este (Lago di Como), 163
- Villa Igela, near Palermo, 91
- Villacabras water, 321, 342, 488, 489, **495**
- Villach (Carinthia), 385
- VILLANOVA, R., 685
- Villar-del-Pozo, 473
- Villars-sur-Ollon, **147**, 154
- Ville d'Avray (near Paris), 287
- Villefranche (Villafraanca), 83
- Villepinte sanatorium (France), 183
- Villers sur-Mer, 124

- Villiers-sur-Marne sanatorium, 183
 Vinadio, 167, **576**
 VINCENTINI, G., 322
 Vineyards, health resorts amidst, 65
 VINTRAS, A., 10, 770
 VISCHOW, R., 656
 Virginia Water, 271
 Visp (Switzerland), 155
 Viterbo, 577
 Vittel, 182, 321, **593**
 Vitznau (Lake of Lucerne), 157
 VIVENOT, von, 41
 Vizakna (Salzburg-in-Transylvania), 436
 Vizella, Caldas de. See *Caldas-de-Vizella*
 Vizzanova (Corsica), 94
 Voelau, 221, 322, **383, 622**
 VOGELSBANG, A., 484, 770
 Vogelsgebirge, resorts of the, 210
 Vogesen. See *Vosges Mountains*
 VOGL, von, 770
 Voirons Mountain, climatic resorts, 153
 VOLLAND, 682
 VOLLMER, E., 770
 Volosca (Abbazia), 97
 Vorder-Todtmoos. See *Todtmoos*
 Vorderdeck, near Borchtesgaden, 212
 Vosges Mountains (Vogesen), French resorts of, 182; German resorts of, 193
 Voyages, sea and ocean, 69-77, 677; effects of, 73; indications for, 75; in pulmonary tuberculosis, 677; disadvantages of, and precautions in the therapeutic use of, 73, 74; contra-indications, 76, 77; best times of year for, 72; private yachts for, 69, 75; special voyages for therapeutic purposes, 74; 'ship sanatoriums' or 'ocean sanatoriums', 74, 677
 Voyages, the 'Nile voyage', 105
 Voyages, to Australia and New Zealand, 71
 Voyages, to Brazil and the Argentine Republic, 70
 Voyages, to Cape Colony and South Africa, 70
 Voyages, to East Indies, China and Japan, 70
 Voyages, to Madeira and the Canary Islands, 69
 Voyages, to North America, 69
 Voyages, to the West Indies, 69
 Vulcana, 230
 Vulpera (Lower Engadine). See under *Tarasp-Schuls*
 Vyrnwy Hotel (Wales), **276, 610**
- WADI HALFA, temperature records, 102
 WAGNER, P., 333, 770
 Walchensee, 213
 Walchsee, 219
 Wald sanatorium (Switzerland), 159
 Waldbreitbach sanatorium, 188
 Waldenburg's method of inspiration from compressed air and expiration into rarefied air, 464, 465
 Waldhaus Flims. See *Flimser Waldh user*
 Wales, inland health resorts, 266, 276
 Wales, resorts for an after-cure to spa-treatment, 609, 610
 Wales, seaside resorts, 250
 Wales, spas of, 266, 267, 421, **548-550**
 Walking and climbing exercise at health resorts, 358. See also *Terrain-Cur*
 Walking tours, 186. See also under *Travelling as a therapeutic agent*
 Wallenstadt, 159
 WALLMANN, H., 770
 Walmer (Deal), 239
 WALSH, W. H., 677
 WALTENHOFEN, 302
 WALTERS, F. R., 10, 628, 770
 WALTHER, A., 403, 734, 764
 WALTHER, O., 627, 628, 679
 Walton-on-the-Naze, 257
 Wangeroo, 126
 Warasdin-Teplitz, 229, **558**
 WARD, R. DE COURCY, 22, 43, 46, 49, 50, 57, 755
 WARD, S. B., 29
 Warmbad (Bad-Wolkenstein), 204, **385**
 Warmbrunn (Prussian Silesia), 205, **381**
 Warnem nde, 128
 Warrenpoint, 260
 Warsaw, 286
 Wartenstein Hotel, above Ragatz, 156, 374
 Warwick, 294
 WASSERMANN, M., 680
 WASSING, A., 770
 WATFEFF, S., 230
 'Water cure.' See *Hydrotherapy*
 Water, glacier water, possible injurious effect of drinking, 302
 Water (mineral water) treatment. See under *Spa-treatment*
 Water (plain water), external use of. See under *Hydrotherapy*
 Water (plain water), internal use of, **301, 302, 370, 602, 603, 715**
 Water (plain water) treatment. See under *Hydrotherapy*
 Water, pure or distilled, hypotonicity of, 302; possible injurious effect of internal use of, 302
 Waterford and its neighbourhood, 261, 280; meteorological means, 280
 Watergate Bay Hotel (Cornwall), 248
 WATERS, A. W., 134, 770
 Waters, mineral. See *Mineral waters*
 Waterville (Kerry), 259
 Watford, 274, 295
 WATSON, CHALMERS, 652
 Weakly mineralised cold waters (gaseous or non-gaseous), 327, **596-604**
 Weakly mineralised warm waters. See *Simple thermal waters*
 'Weather,' definition of, 15
 'Weather sensations,' appreciation of climates by, 27, 52
 Weather, uncertainty in regard to at all health resorts, 623, 631
 WEBER, F. PARKER, 55, 60, 616, 649, 651, 669, 674, 683, 698, 700, 708, 733, 770, 771, 772
 WEBER, K., 289

- WEBER, Sir H., 10, 16, 35, 36, 49, 50, 53, 59, 67, 81, 86, 101, 106, 135, 138, 141, 235, 282, 631, 632, 635, 645, 671, 676, 677, 684, 692, 714, 722, 728, 748, 771, 772
- WEBER, V., 564
- Weesen (Lake of Wallenstadt), 159
- Weggis (Lake of Lucern), 157
- Wehrwald Sanatorium (Todtmoos), 198
- WEICKER, H., 205, 628
- Weilbach, Bad, 191, 467, **553**
- Weimar, 294
- 'Weinbrunnen' of Schwalbach, 501
- Weinheim, 193
- Weir-Mitchell treatment, 357, 644, 728
- Weissbad (Appenzell), 159
- Weissenburg, Bad, 156, 582, **589**, 609, 678, 692
- Weissenfluh Hotel (above Vitznau), 158
- Weissenstein, Kurhaus (Swiss Jura), 150
- Weissenstein, Schloss (Tirol), 217
- Weisser Hirsch (near Dresden), 204
- Weisshorn Hotel, above Vissoye, 147
- Well-fever. See *Poussé thermale*
- Wells (Somerset), 294
- Wemding, Wildbad, 324, **558**
- Wemyss Bay, **253**, 314
- WENDT, 35
- Wengen (Switzerland), **149**, 607
- Wengernalp (Switzerland), 149
- Werl, 434
- Wernarzerquelle of Brueckanau, 512, 589
- Werne, 424
- Wernigerode, **199**, 607
- WERRA, J. DE, 148, 386, 772
- WENTHEIMER, 660
- West Indies, voyages to, 69
- West Kirby, 252
- Westcliff-on-Sea, 257
- Westerham (Kent), 274
- Westerland (island of Sylt), 127
- Westerplatte, 130
- Westerwald, resorts of the, 188
- Westgate-on-Sea, 239
- Westmorland Sanatorium, the, 253
- Weston-super-Mare, 249
- WESTPHALEN, H., 706
- Westport (Clew Bay), 259
- Westward Ho, 249
- WETHERED, F. J., 628
- WETTSTEIN, 45
- Weybridge, 271
- WEYER, E., VAN DE. See VANDEWEYER, E.
- Weymouth, **245**, 548; sulphur springs near, 548
- Wharfedale (Yorkshire), 276
- Whey cures, 459, 505, **620**, 715, 717; localities for, 621; medicated whey, 'Eisenmolke,' 620
- Whitby, 255
- Whitmead Hill Sanatorium (near Farnham), 273
- Whitstable, 238
- Wick, L., 321, 329, 332, 372, 382, 772
- Wicklow Hills, 261
- WIDENMANN, 93
- Widerstands-Gymnastik. See *Exercises, resistance*
- Wiedenfelsen (Black Forest), 195
- Wien. See *Vienna*
- Wienerwald, resorts of the, 221
- Wienerwald sanatorium (near Pernitz), 221
- Wiesau, König-Otto-Bad near, 512
- Wiesbaden, 190, 296, 320, 322, 329, 360, 367, 368, **416**, 625, 634, 648, 703
- Wiesbaden 'Gichtwasser,' 350, 416
- Wiesen, 139
- Wiesenbad, 204, **385**
- Wight, Isle of, 243; the Undercliff or 'Riviera' of, 164, **243**
- 'Wild-Bad,' the, as at Wildbad in Würtemberg, 375
- Wildbad (Würtemberg, Black Forest), 195, 371, **373**, 607, 609, 700; the 'Wild-Bad' at, 375
- Wildbad-Adelholzen. See *Adelholzen*
- Wildbad-Burgbernheim. See *Burgbernheim*
- Wildbad-Empfang. See *Empfang*
- Wildbad-Gastein. See *Gastein*
- Wildbad-Innichen. See *Innichen*
- Wildbad-Kreuth. See *Kreuth*
- Wildbad-Neumarkt. See *Neumarkt*
- Wildbad-Rothenburg. See *Rothenburg*
- Wildbad-Wemding. See *Wemding*
- 'Wildbaeder,' 324
- Wildegge (Switzerland), 160, **439**
- Wildungen, 210, 356, 468, 582, 583, **584**, 715, 717
- Wilhelmina spring at Haarlem, 504
- Wilhelminenbad, 128
- Wilhelmsglücksbrunn, near Eisenach, 427
- Wilhelmshaven, 127
- Wilhelmshöhe, **209**, 314
- Wilhelmsquelle at Kronthal, 598
- WILL, H., 772
- WILLIAMS, C. J. B., 772
- WILLIAMS, C. THEODORE, 10, 59, 79, 676, 677, 690, 772, 773
- WILLIAMS, LEONARD, 597, 636, 772
- WILLIAMS, W., 767
- WILSON, C. T. R., 32, 322, 329
- WILSON, J., 772
- WILSON, W. S., 772
- Wimbledon and Wimbledon Common, 283, 295
- Wimpfen, 434
- Winchester, 294
- WINCKLER, A., 554, 772
- Windermere, 276
- Winds, 39, 42. See also *Cyclones, Trade winds, Monsoons, Simoon, Khamseen, Harmattan, Mistral, Sirocco, Foehn, &c.*
- Winds, importance of woods in regard to shelter, 50
- Winds, influence of, 46; in regard to pulmonary tuberculosis, 47, 673, 680
- Winds, morning and evening winds, 42
- Winds, sea-breeze and land-breeze, 42
- Winds, summer and winter winds, 43
- Winds, valley and mountain winds, 42; exception to the rule in regard to the direction of mountain winds, 42
- Windsor, 271

- WINTER, 403
 Winter resorts compared, tables of atmospheric temperature means, **236**, 280, 291, 293
 WINTERITZ, H., 772
 WINTERITZ, W., 221, 300, 301, 302, 304, 305, 308, 309, 310, 312, 340, 660, 679, 773, 774
 Wipfeld (Ludwigsbad), 210, 337, **555**
 Wirral Peninsula, resorts of the, 252
 WISE, A. T. TUCKER, 626
 Withernsen, 256
 Wittdün (Island of Amrum), 127
 Wittekind, 429
 WIZARD, A., 773
 Woburn Sands, 275
 Wocheiner See, the (Carniola), 223
 Woerishofen, 213
 Woerther See (Carinthia), the, 223
 WOLFF, F., 60, 773
 Wolkenstein, Bad (Warmbad, near Wolkenstein), 204, **385**
 Wollin, Island of, 129
 Woodenbridge, 261
 Woodhall Spa, 265, 399, 401, **419**, 719, 721
 Woods and forests, effects on the atmosphere and climate of a locality, 50
 Woods-HUTCHINSON, 652
 Woolacombe, 249
 Worcester, 294
 Worms, 294
 Worthing, and meteorological means for, **242**, 280
 Wounds, old, 370, 371
 WRIGHT, Sir A. E., 347, 348, 583, 618, 620, 680, 714, 743
 WROTH, WARWICK, 504
 Wuermsee, the, 213
 Wuerzburg, 625
 WYBAUW, R., 367, 496, 498, 770, 773
 Wyk (Island of Foehr), 127
 Wyquelle of Tarasp-Schuls, 484
 XENON, in the atmosphere, 17
 Xeroderma pigmentosum, 29, 742
 YALTA (Crimea), 101
 Yarmouth (Isle of Wight), 244
 Yarmouth (Norfolk), **257**, 280; meteorological means for, 280
 Yarrow convalescent home (Broadstairs), 239
 Ydes, 491
 YEO, I. BURNEY, 10, 121, 238, 316, 325, 344, 621, 773
 York, 294
 Yorkshire, coast of, 255
 Youghal, 258
 YOUNG, E. H., 622
 Yverdon, **160**, **560**
 ZAANDAM chalybeate water, 505
 Zaizon, 517, **600**
 Zakopane, 227
 Zander's medico-mechanical appliances, 357, 358
 Zandvoort, 126
 ZANGGER, T. F., 64
 Zante (Ionian Islands), 99
 ZAUDY, 452
 Zeidlweid, 517
 Zell-am-See, **220**, 607, 609
 Zell-am-Ziller, 219
 Zermatt, **146**, 607
 ZIEHSE, H. VON, 773
 Zinal (Switzerland), 147
 Zollihaus, 'Johannis' water from, 190, 598
 'Zomotherapy' (raw meat or meat-juice treatment), 685
 Zoppot, **129**, 131
 Zuerich, and the Lake of Zuerich, **158**, 287, 296
 ZUNTZ, N., 58, 60, 62, 773
 Zuz, 144
 Zweisimmen, 156
 Zwieselbad (Bad-Abtenau), 494

